SERIES P8511-000-P

Single Axis Position Controller
for regulated (PID) positioning

- PID – regulated analogue positioning with +/- 10 VDC
- Integrated power pack (115/230 VAC)
- Single set operation
- Up to three different speeds
- Manual (inching) operation
- Extensive functions and parameters

1. Short Description

Whilst the P8511-000-P with option Analogue-output is specifically designed to provide closed loop (Proportional, Integral, Differential) analogue control of 4 quadrant drives, it also serves the purpose of operating as a 2 or 3 speed controller, as the P8511-000-R.

When used as a closed loop controller, it is essential that: -
1. A 4 quadrant drive – usually a high dynamic servo drive, is used.
2. The drive is capable of accepting a +/- reference signal for direction, without a dead-band.
3. The Encoder is torsional rigidly coupled to motor.
4. The mechanics of the machine are backlash-free.

Whilst it is possible to use lower specification drives and mechanics, it may then not always be possible to achieve the performance and accuracy which is commonly expected of a closed loop system. When using a simple Inverter driven AC motor, it is essential to use the drive in F/V or FCC mode, rather than the full Flux Vector (which tends to fight the position controller at low speeds).

- 2 or 3 speed positioning
- Absolute and incremental positioning modes
- Operation in Single positioning mode
- Operation in manual, slow and fast mode
- Quantity counting with completed output
- Flexible multiplier for Display calibration
- Datum setting routines
- Tool offset compensation in incremental mode
- Incremental error compensation
- Backlash compensation
- Tolerance window blanking
- Encoder and drive failure detection
- Maximum Encoder frequency 20 kHz

The unit is suitable for operation with any type of 2 or 3 speed bi-directional drive or any variable speed drive with 1, 2 or 4 quadrant of control. The performance and accuracy obtained is dependent on the type of drive chosen. The outputs for stepped speed drives are transistors.
These outputs can be configured in a number of ways to suit all types of control circuits.
The actual position is monitored by an incremental encoder. The power supply unit can be integrated. The controller can be used to position machinery to any desired absolute position.
Alternatively, the controller can be used to feed material through a process.

As an Analogue closed loop controller, it has the additional features of :

- Analogue output +/- 10 VDC
- Top speed setting
- Acceleration/Deceleration rate settings
- PID term optimisation
- Go to Datum routines

2. Functions

2.2 Two speed operation

NB: R1 = R2 > R3   The value in Register 1 must be the same value as Register 2

Fast (and slow)   Demand position

creep

Stop Offset   P 3
Creep point   P 2
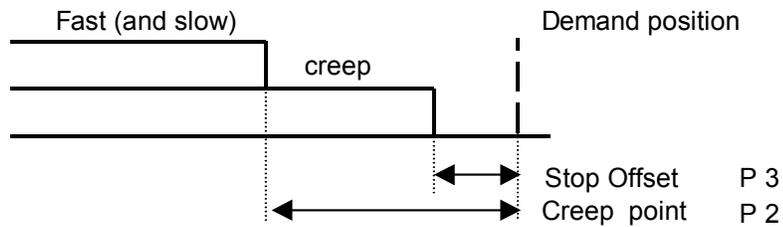
2.2 Three speed operation

NB: R1 > R2 > R3   The value in Register 1 must be larger than Register 2

Demand position

Fast

slow

creep

Stop Offset   P 3
Creep point   P 2
Slow point   P 1
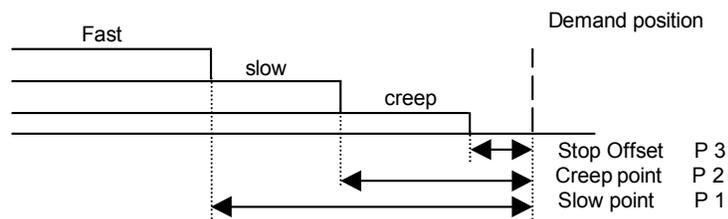
NB: The stop offset is only effective when R8 = 1xxxxx.

2.3 PID - Analogue +/- 10 V regulation (optional)
The setting is effected using Registers R50 to R66

Speed

D

I

P

I – Limit or
Target speed

Time
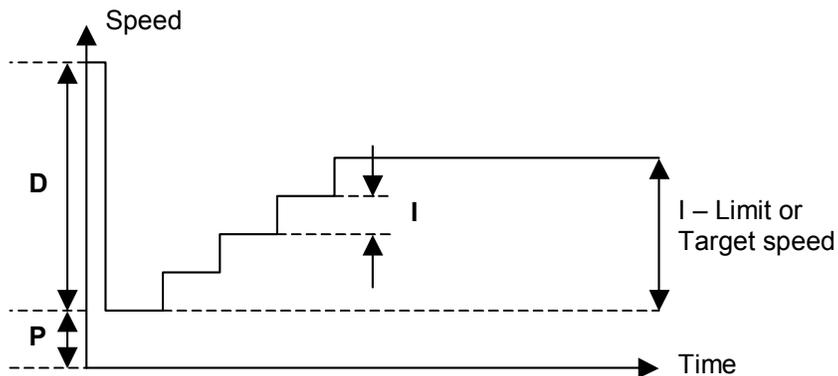
2.3   Setting Datum

Datum can be set in a variety of ways. The method is selected in Register R8/3

R8 = xx0xxx   Datum to R7
                 Closing input St 3 / 4 transfers the value set in R7
                 into Actual Value Display

R8 = xx1xxx   Setting to Preset
                 Closing input St 3 / 4 transfers the Target display
                 value into Actual Value Display

R8 = xx2xxx   Automatic Datum setting - direction positive

R8 = xx3xxx   Automatic Datum setting - direction negative

R8 = xx4xxx   Datum with keypad alone
                 The value of R7 is transferred to Actual Display by
                 accessing R7, typing in value and then pressing E.

Operation of "Go to Datum"

After "power on", initiating "Start" or "Datum" will cause the Axis to move in the direction set in R8/3. The output "Going to datum" St5/7 is active.

When the Axis activates the respective end limit switch, it will stop for a time as set in R10. It will then move slowly in the opposite direction. When it crosses off the limit switch, the Encoder marker input St1/8 is enabled. When the next marker pulse is detected, the Axis stops and value of R7 is loaded into actual window.

The going to datum output is now turned off.

The speeds for going to Datum are set as follows ;-

1. Analogue control
   First phase (from start to hitting end limit)
           Speed set in R67 (rpm)
   Second phase (from reversal to marker pulse)
           Speed set in R68 (rpm)

2. Switched speed control
   First phase (from start to hitting end limit)
           Speed set in R69
           For Creep speed R69 = xxxxx0
           For Slow speed   R69 = xxxxx1
           For Fast speed   R69 = xxxxx2
   Second phase (from reversal to marker pulse)
           Speed is always equal

2.4   Encoder Monitoring

If, after positioning is activated, no Encoder pulses are received after a time set in R19 (0.1 to 9.9 sec), positioning will be aborted and fault 01 will be displayed.
Setting R19 to 0.0 sec, disables this feature.

2.5   Quantity Counter

Register R18/6 sets the method of counting whether adding or subtracting

R18 = xxxxx1   Automatic subtracting
R18 = xxxxx2   Automatic adding
R18 = xxxxx3   Manual subtracting (external input signal)
R18 = xxxxx4   Manual adding (external input signal)
R18 = xxxxx5   Automatic add/subtract (Single only)
R18 = xxxxx6   Manual add/subtract (Single only)

With adding function, the counter starts from zero. When the set quantity is reached, the quantity complete output will be pulsed. With subtracting function, counting from preset to zero takes place. When zero is reached, the quantity complete output will be pulsed.

With add/subtract function, subtracting will take place if a preset value is entered. On reaching zero, adding will ensue. When the quantity counter goes from 1 to 0, a pulse output is given.
The length of this pulse is set in P11. Setting 0.0 gives a maintained output.

2.6   Fault Monitoring

When a fault occurs, it's number flashes in Actual Value Display

Fault number 01 =   Encoder
              02 =   End Limit minimum
              03 =   End Limit maximum

              04 =   Actual Position < min software limit (R13)   Hand
                     Target Position < min software limit (R13)   Single

              05 =   Actual Position > max software limit (R14)   Hand
                     Target Position > max software limit (R14) Single

            * 07 =   External stop activated or wire break

The fault message is cleared by pressing any button.
"07" also flashes if Stop on front panel is activated in middle of any move.

*NB: External stop input must be linked before system can operate. Therefore, if external n/c pushbutton is not fitted, then insert a permanent wire link.

3. Front Panel
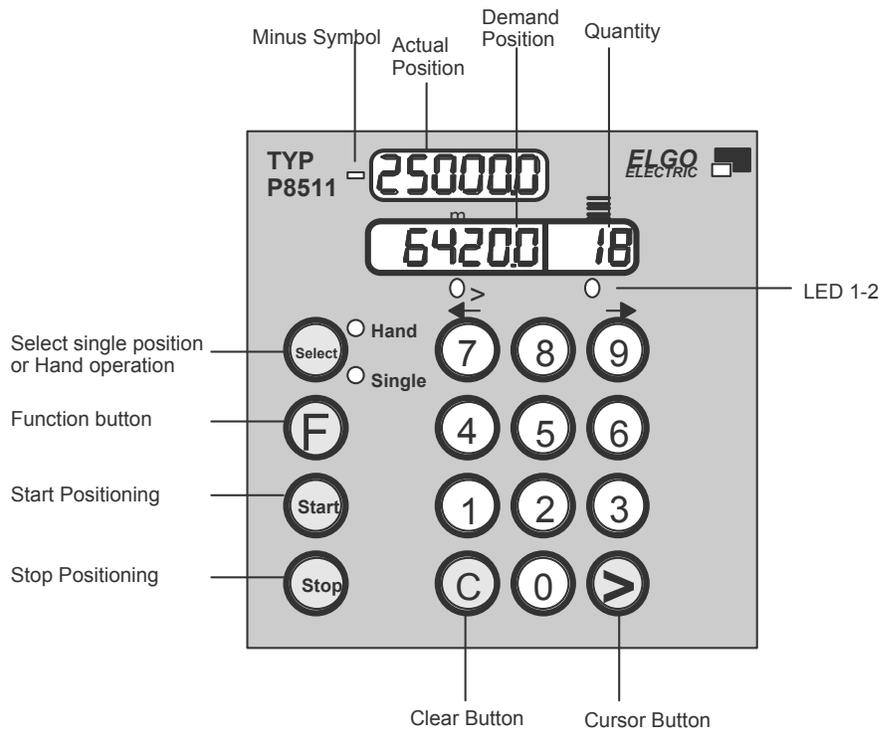
3.1   Functions of Display

Actual Position Shows the Actual Position of the axis
Target Position   Here you can enter the required position (or Register value)
Quantity Window   Shows how many pieces are left to be cut (or have been cut)
                       or How many incremental moves yet to be completed.
LED "Hand"   Illuminates when button "Select" is pressed
LED "Single"   Illuminates when button "Select" is pressed
LED 1 - 2   Indicate which input window is being used selected by button >

3.2.   Function of the Keypad

Select   Selecting Single enables operator to enter a position Target value. Pressing > enables
            quantity value to be entered. Pressing "**Select**" again enables Hand operation.
            Using Buttons **7 & 9** the Operator can move the axis manually
F   Selects the Register setting mode (only active in Single)
Start   Start positioning action. Start is inactive in Register setting mode and Hand mode
Stop   Stops positioning action. Also clears error code. Stop is inactive in Register mode and
            Hand mode.
>   Sequentially selects Dimension or Quantity window. In Register setting mode selects
            alternatively:- Register number and Register value.
C   Clears the selected window to zero
0-9   Numerical Keypad for entry of values at all times

4. Controller in Operation

Switch on conditions is programmable in register R33:

        R33 = xxxxx0   same conditions as at time of switch off
        R33 = xxxxx1   Single mode
        R33 = xxxxx3   Hand mode

The Actual position is memorised. In "Hand" the Target window line is switched off. In "Single" the Target value is memorised

4.1 Position to new value

Press C	:	Clear Target position value
Press 0-9	:	To enter desired position
Press >	:	Select quantity demand
Press C	:	Clear quantity value
Press 0-9	:	To enter desired quantity
Press >	:	To ensure correct window selected
Press start	:	The axis moves to desired position

4.2 Manual operation (Hand)

Use the button "Select" to select Hand (LED illuminates).
Use button 7 (forwards) & 9 (backwards) to move axis
The direction of rotation can be selected in P64
The buttons 7 & 9 have twin functions :-

Initially the axis moves at slow speed. When the time set in P32 has elapsed, the axis changes into high speed. This condition continues till button is released.

In high speed, when the Actual position reaches preset software limits (P13 + P1) or (P14 - P1), the speed automatically drops to creep.

5. Setting of Registers

5.1   Register Input

Press F for 2 sec   The digits in Actual value display flash.
98 is displayed when Registers are protected by security code.

To unlock Registers :-

Press >   Select Target window

Enter 250565   The security code

Thereafter, the required Register is displayed. To alter value of Register proceed as follows:-

Press >   The Actual value display reads 01 for Register 1

Use keypad 0 to 9   To enter desired Register number

Press >   The value of that Register is displayed in Target Window

Press C   To clear old value

Use keypad 0 to 9   To enter desired Register value

Press >   The Register value is stored in memory. The Actual Value display indicates next Register number

A number of Registers may be set sequentially.

Press F for 2 sec   The Register entry is ended. Actual position is again displayed

Registers without function cannot be accessed.

Once Registers have been unlocked, you may alternate between operation and Register entry mode without the need for further security code entry.

The Registers can be locked away, by either

Powering down, or

Selecting Register 98; press > ; press F for 2 sec.

6. Register List

Register	Function	Resolution	Suggested initial setting	Customer
01	Slow speed distance	0.1 mm	200	
02	Creep speed distance	0.1 mm	100	
03	Stop offset	0.1 mm	0	
04	Backlash compensation	0.1 mm	50	
05	Retract distance	0.1 mm	500	
06 *	Tool Width	0.1 mm	0	
07	Datum value	0.1 m	1000	
08	System Register 1	See para 7.8	000000	
09	Position reached pulse	0.1 s	10	
10	Backlash dwell time	0.1 s	10	
11	Quantity reached pulse	0.1 s	10	
12	Tolerance window	0.1 mm	0	
13	Min software limit	0.1 mm	0	
14	Max software limit	0.1 mm	500000	
15	Software limit selection	See para 7.15	000000	
17	Display brightness	0-15	10	
18	System Register 2	See para 7.16	000001	
19	Encoder pulse monitor time	0.1 s	0	
20	Decimal point	See para 7.17	0	
24	Backlash distance 2	0.1 mm	0	
25	Fixed Position	0.1 mm	1000	
28	System Register 3		000000	
29	Time delay for Drive inhibit	0,1 sec	10	
30	Programme end pulse	0,1 sec	10	
31	Closed loop inhibit time in Hand	0,1 sec	10	
33	Controller switch on condition	0,1 sec	0-2	
34	Start time delay time	0,1 sec	10	
40*	Programme Block selection	See para 7.22	1	
41	Number of lines in Prog Block	1-99	20	
50	Speed	UPM 1-10000	10	
51	Acceleration/Deceleration	revs/sec2	10	
52	P term	1-3000	100	
53	I term	1-1000	1	
54	D term	1-1000	1	
55	I limit	1-1000	1	
56	Encoder edge multiplier	1,2,4	1	
57	Encoder pulses per rev	1-10000	100	
58	Stop-ramp selection	1-3	000000	
60	Speed back hand slow	Rpm	100	
61	Speed back hand fast	Rpm	1000	

62	Speed forward hand fast	Rpm	1000	
63	Speed forward hand slow	Rpm	100	
64	Direction of manual buttons	0.1	0	
65	Speed to fixed position	Rpm	500	
66	Acceleration for fixed position	revs/sec2	5	
67	Speed datum sequence phase 1	Rpm	100	
68	Speed datum sequence phase 2	Rpm	10	
69	Speed datum sequence with relays phase 1	0,1,2	0	
88	System Register 4	See para 7.42	000000	
90	Button enable in service mode	0,1,2	0	
94	Inch / factor multiplier	0.0to 9.99999	0	
96	Encoder pulse multiplication 0.00001 to 9.99999		100000	
97	Inch / mm selection	0,1,2,3	0	
98	Security code	250565		
99	Service	- -		

*Logical sequence values such as these must always be present, regardless whether
3 speed, 2 speed or 1 speed drive is used.
P1 > P2 > P3 for 3 speed drive   P1 = P2 > P3 for 2 speed or 1 speed drive.

Registers R06 and R07 can be accessed and changed without need for the Security Code.
The Registers R50 to 55, 57 to 63 and 65 to 68 are for analogue output only.

7. Description of Registers

R01   Slow speed distance forward/reverse or forward only (see R28/2)

Distance at which the controller switches from high speed to slow speed. The output high speed will be switched off.

R02   Creep speed distance forward/reverse or forward only (see R28/2)

Distance to demand position at which the controller switches from slow to creep speed

R03   Stop offset distance forward/reverse or forward only (see R28/2)

The overrun distance can be programmed to compensate for distance from the switch-off point of the motor to standstill. For exact positioning, the overrun distance should be very small (0.0 to 0.5 mm). Therefore the mechanical friction should be steady and the creep speed should be very slow.

During commissioning, first set R12 to zero (to eliminate Tolerance window blanking), then set the value of R03 to 0.0 and execute a number of moves in both directions. Note the average overrun distance and then set R03 to that value. Then set R12 to suit.

R04   Backlash overrun

To correct for screw or pinion backlash, the Target position should be approached from one direction only. In positive direction therefore, the Target position will be overrun by the value of R4 and driven back at creep speed after a time delay of R10, to the Demand position.

R05   Retract distance

There are different modes available in the P8511, selectable by Register R18/2.

If R18/2 = 0   Retract Position = Actual + R5
If R18/2 = 1   Retract Position = Value of R5

Whilst the input St3/6 is held on, the slide will move to the "Retract" position. On release of input, slide will return to the original position. (Value 0)

When input St3/6 is activated, the slide moves to position as set in R5 but will not return to original position on release of input. (Value 1)

R06   Tool offset compensation

This Register can be accessed without Security Code. When moving in incremental, it is often the case that the subsequent function is a cut that removes part of the material. Thus to cut the correct preset lengths, it is necessary to move the demanded distance plus the "Tool Offset". This feature is active in incremental mode.

R07   Datum

The Datum value is stored in this Register. The value is used in different ways, in accordance with setting of P8/3. Input St3/8 initiates loading. This Register can be accessed without Security Code.

R08   System Register 1

This Register sets the basic operating functions of the unit.

```
1 2 3 4 5 6
```

Backlash
0 = no backlash compensation
1 = negative backlash comp
2 = positive backlash comp
3 = negative backlash on start in R24 window
4 = positive backlash on start in R24 window

Output Relay Configuration
0 = 3 speed operation - Fast, Slow and Creep
1 = 2 speed operation - Forwards & Backwards
2 = 2 speed operation - Run & Reverse
3 = Separate outputs - Fast & Slow forwards, Fast & Slow reverse.
4 = 3 speed operation forwards - Reverse direction is Fast only.
5 = 3 speed Binary coded - Forwards & Backwards
6 = 3 speed operation - Forwards & Backwards

Option

Datum
0 = Datum to R7 with external pulse by key-switch
1 = Datum to Target position window with external key-switch
2 = Automatic datum to positive direction limit
3 = Automatic datum to negative direction limit
4 = Datum to R7 by key-board only

Option

Type of positioning
0 = Analogue positioning
1 = Fast/slow/stop

Output Configurations

These depend on setting of Register R8/5

Value 0   3 speed operation (Elgo standard default)
                3 speeds selected by relays 1,2 & 3
                output 4 sets direction reverse

OUTPUT ST5/	1	2	3	4
Creep forwards	X			
Slow forwards	X	X		
Fast forwards	X	X	X	
Creep reverse	X			X
Slow reverse	X	X		X
Fast reverse	X	X	X	X

R1 = Run, R2 = Slow & R3 = Fast combined with Run.
If used with 2 speed, R2 or R3 = Fast.
Can also be used with single speed.

Value 1   2 speed operation
                Independent outputs forward and reverse
                Independent outputs fast and slow

OUTPUT ST5/	1	2	3	4
Creep forwards	X	X		
Slow forwards				
Fast forwards	X		X	
Creep reverse		X		X
Slow reverse				
Fast reverse			X	X

R1 = Run forwards, R4 = Run reverse, R2 = Creep, R3 = Fast

Value 2   2 speed operation
                Speed set by Relays 2 & 3
                Direction set by Relay 4

OUTPUT ST5/	1	2	3	4
Creep forwards	X	X		
Slow forwards				
Fast forwards	X		X	
Creep reverse	X	X		X
Slow reverse				
Fast reverse	X		X	X

R1 = Positioning (drive inhibit or brake)
R2 = Creep, R3 = Fast (both independent)

Value 3   2 speed operation
Independent outputs for direction and speed

OUTPUT ST5/	1	2	3	4
Creep forwards	X			
Slow forwards				
Fast forwards		X		
Creep reverse			X	
Slow reverse				
Fast reverse				X

Value 4   3 speed operation
Forwards – 3 Outputs set speeds
Reverse – always fast
Output 4 = reverse

OUTPUT ST5/	1	2	3	4
Creep forwards	X			
Slow forwards	X	X		
Fast forwards	X	X	X	
Creep reverse	X	X	X	X
Slow reverse	X	X	X	X
Fast reverse	X	X	X	X

Value 5   3 speed operation
Binary coded Outputs 2 & 3 for speed
Output 1 = Forwards, Output 4 = Reverse

OUTPUT ST5/	1	2	3	4
Creep forwards	X	X		
Slow forwards	X		X	
Fast forwards	X	X	X	
Creep reverse		X		X
Slow reverse			X	X
Fast reverse		X	X	X

Value 6   3 speed operation
Output 1 = Run forwards, Output 4 = Run reverse

OUTPUT ST5/	1	2	3	4
Creep forwards	X			
Slow forwards	X	X		
Fast forwards	X	X	X	
Creep reverse				X
Slow reverse		X		X
Fast reverse		X	X	X

R09 Time position reached
During each move the controller gives an output to signal "positioning". When 'in position' the output is deactivated for the length of this pulse set in R9. Setting 0.0 gives a maintained output. This output St5/14 is inactive when Actual position = Target position +/- Tolerance window R12

R10 Backlash dwell time
When the machine stops at the end of the overrun, it is usually desirable to have a short delay. The time is set in this Register.

R11 Pulse "Quantity complete"
When the quantity counter goes from 1 to 0, a pulse output at St5/16 is given. The length of this pulse is set in R11. Setting 0.0 gives a maintained output.

R12 Tolerance window
It is possible to enter a value in Register R12 that represents an acceptable tolerance e.g. 0.1 mm. When the Actual Position is within the Tolerance window, the Actual position displayed is made equal to the Target position. The actual error is not lost, as the controller knows the true position.

Example: R12 = 0.2   Therefore tolerance window is +/- 0.2mm

Display without Tolerance set   Display with tolerance set

$$1998$$ Actual Display $$2000$$

$$2000$$ Demand Display $$2000$$
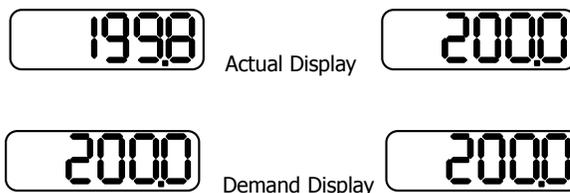
R13/R14 Min/Max software limits

		Fault Message
Target < Limit R13	=	04
Target > Limit R14	=	05

Single Operation
Immediately after start signal, the controller checks the software limits. If the Target position is greater or smaller than the corresponding limit, the controller will stop and show the error message on the display. The backlash distance in R4 is considered at the check of the Max software limit, if the backlash is activated in R8/6.

Hand Operation
The movement will stop when software limits are reached. If moving at high speed, the drive will drop to creep speed at a distance set in R1 from this limit. This prevents

running into the ends of the machine. The end limit values are modified by backlash value as set in R4, if R8/6 is selected.

R15   **Software Limit / End Limits Selection**

Software limits (R13 & R14) are active in accordance with the setting of R15/6

xxxxx0   Both software limits active
xxxxx1   Min software limit (R13) inhibited
xxxxx2   Max software limit (R14) inhibited
xxxxx3   Both software limits (R13&R14) inhibited

External limit switches can be connected to the St3/3 negative direction and at St3/7 for positive direction.

xxxx0x   Both limits inputs active
xxxx1x   Min limit input (St3/3) inhibited
xxxx2x   Max limit input (St3/7) inhibited
xxxx3x   Both software limit inputs (St3/3 St3/7) inhibited
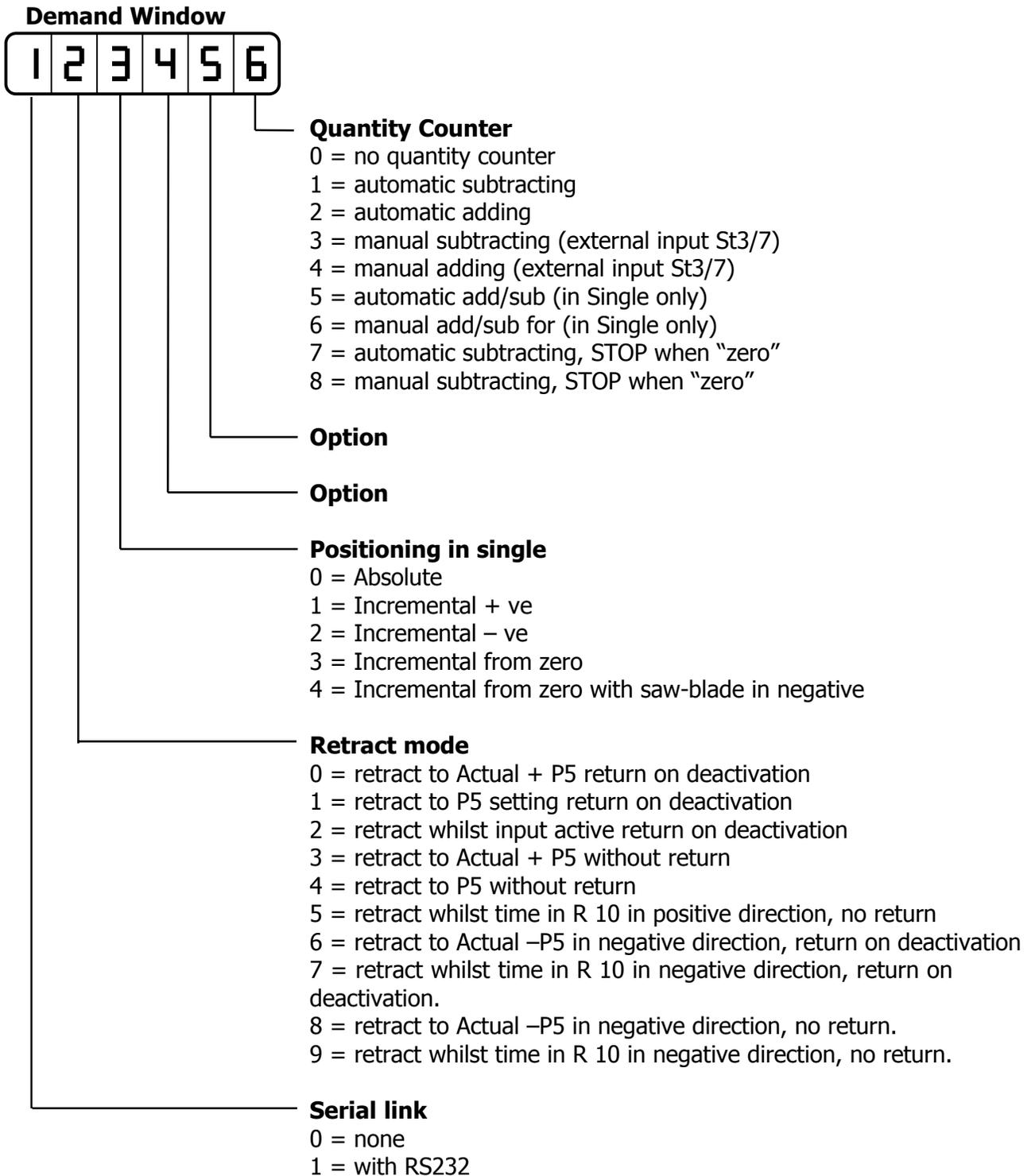
N.B If these are not connected to limit switches they need to be connected Normally closed (i.e. linked out).

R17   **Display Brightness**

Setting this parameter changes the brightness of the display.
0 = dark, and 15 = maximum brightness.

R18   System Register 2

This Register also sets the functions of the controller.

Demand Window

```
| 1 | 2 | 3 | 4 | 5 | 6 |
```

Quantity Counter
0 = no quantity counter
1 = automatic subtracting
2 = automatic adding
3 = manual subtracting (external input St3/7)
4 = manual adding (external input St3/7)
5 = automatic add/sub (in Single only)
6 = manual add/sub for (in Single only)
7 = automatic subtracting, STOP when "zero"
8 = manual subtracting, STOP when "zero"

Option

Option

Positioning in single
0 = Absolute
1 = Incremental + ve
2 = Incremental – ve
3 = Incremental from zero
4 = Incremental from zero with saw-blade in negative

Retract mode
0 = retract to Actual + P5 return on deactivation
1 = retract to P5 setting return on deactivation
2 = retract whilst input active return on deactivation
3 = retract to Actual + P5 without return
4 = retract to P5 without return
5 = retract whilst time in R 10 in positive direction, no return
6 = retract to Actual –P5 in negative direction, return on deactivation
7 = retract whilst time in R 10 in negative direction, return on deactivation.
8 = retract to Actual –P5 in negative direction, no return.
9 = retract whilst time in R 10 in negative direction, no return.

Serial link
0 = none
1 = with RS232

R19 Encoder monitoring

If after positioning is initiated, no Encoder pulses are sensed after a time set in R19, positioning will be aborted and Fault 01 will be displayed. Setting R19 to 0.0, disables Encoder pulse monitoring.

R20 Decimal Point

The decimal point is placed in a fixed position and is optional only. It does not change the resolution of the system. The position is dependent on setting of Register R97.

With R97 = xxxxx0 = mm mode
R20 = xxxxx0 = without
R20 = xxxxx1 = 1/10
R20 = xxxxx2 = 1/100
R20 = xxxxx3 = 1/1000

With R97 = xxxxx1 = Inch mode 1/100
Decimal point is fixed at 1/100

With R97 = xxxxx2 = Inch mode 1/1000
Decimal point is fixed at 1/1000

With R97 = xxxxx3 = "Inch" factor freely programmable in R94
R20 =xxxx0x = without   R20 =xxxx1x = 1/10
R20 =xxxx2x = 1/100   R20 =xxxx3x = 1/1000

R21 Slow speed distance in negative direction

This parameter is important for application with different load conditions on forward or backward if no use of automatic backlash compensation is desired. The Parameter R28/2 has to be set to 1 for activation.
Distance at which the controller switches from high speed to slow speed in negative direction (the output high speed will be switched off).

R22 Creep speed distance in negative direction

Distance to Target position in negative direction can be set in this parameter at which the controller switches from slow to creep speed

R23 Stop offset distance in negative direction

The overrun distance in negative direction can be programmed in this parameter to compensate for distance from the switch-off point of the motor to standstill.
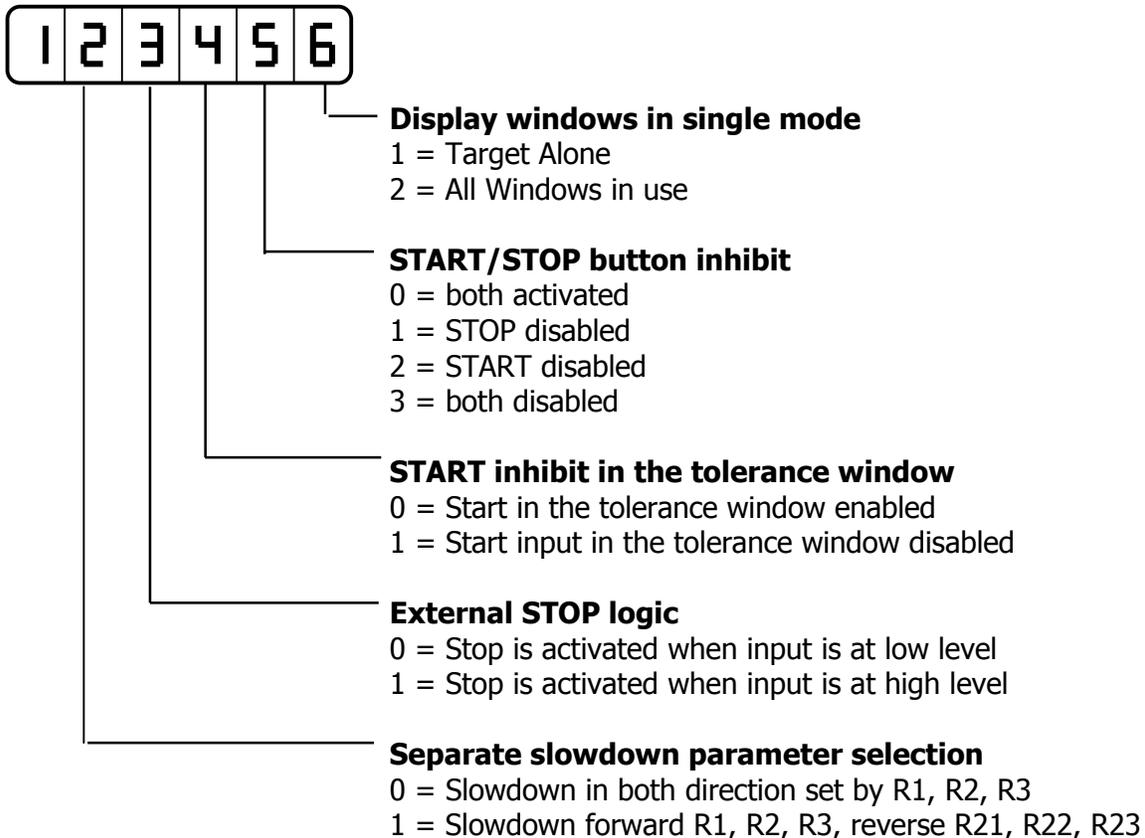
R25 Home Position

Activating the input St3/19 will send the Axis to a prefixed position as set in R25.

R28　System Register 3

This Register also sets the functions of the controller.

Target Window

```
┌─┬─┬─┬─┬─┬─┐
│1│2│3│4│5│6│
└─┴─┴─┴─┴─┴─┘
```

Display windows in single mode
1 = Target Alone
2 = All Windows in use

START/STOP button inhibit
0 = both activated
1 = STOP disabled
2 = START disabled
3 = both disabled

START inhibit in the tolerance window
0 = Start in the tolerance window enabled
1 = Start input in the tolerance window disabled

External STOP logic
0 = Stop is activated when input is at low level
1 = Stop is activated when input is at high level

Separate slowdown parameter selection
0 = Slowdown in both direction set by R1, R2, R3
1 = Slowdown forward R1, R2, R3, reverse R21, R22, R23

R29　Time Delay for Drive inhibit (Positioning)

On activating start, output St5/15 is activated. On arriving in position, after a time delay of R29 this output deactivates.

R32　Start delay time

When in Hand mode and the delay time set in this parameter has elapsed, the controller will move from slow speed to fast speed operation.

R33　Power on mode

This parameter sets the switch on conditions of the unit.

R33 = xxxxx0 same conditions as at time of switch off
R33 = xxxxx1 Single mode
R33 = xxxxx3 Hand mode

The Actual position is memorised. In "Hand" the Target window line is swiched off. In "Single" the Target value is memorised

Parameters for Analogue (PID) Control (R50-R58)

R50   Speed (input in rpm, referred to Encoder)

The maximum speed is set in this Register, in rpm. The speed is monitored by
the Encoder speed (1 – 10000 rpm). Should there be gearing between motor and
Encoder, this must be considered in the calculation to set R50.

Example : Required motor speed in rpm = 3000
           Gearing ratio   i   = 10
           Therefore R50 = rpm/i = 3000/10 = 300

Edge multiplier and Multiplication factor must not be considered in the calculation (see
example in section 9.3, page 31)

R51   Acceleration (Deceleration) (input in revs/sec2 referred to Encoder)

The acceleration is set in this Register in revolutions per second squared.
(see example in section 9.4. page 31)

R52   P Term (Proportional Amplification; setting 1 – 3000)

During operation, the difference between Target and actual positions will be multiplied
by the value of this Register and result in an Analogue output. The greater the
proportional amplification, the more responsive (eventually also unstable) will be
the system.

Hint : when using dc Servo-drives, the value should not exceed 20.

R53   I Term (Integral step, setting 1 – 1000)

During operation, the Analogue control voltage will continue to increase step by step,
until there is zero difference between Target and actual position. The maximum increase
in voltage is limited by R55. The greater the I term, the slower is the response.

R54   D Term (Differential voltage, setting 1 – 1000)

During operation, any small error in the output voltage will be compensated for by
increasing the voltage instantaneously, but without instability of the system.
The value of the instantaneous voltage is set in this Register (max +/- 10v =1000).

R55   I Limit (Integral Limit, setting 1- 1000)

The Integral voltage (R53) will only increase step by step up to a value as set in this
Register to prevent the Integral term becoming too large, should it not be possible for
some reason to reduce the error to zero.

NB: R55 must be set to a value greater than R53 !

R56   Encoder Edge Multiplication

1 = x 1   2 = x 2   4 = x 4
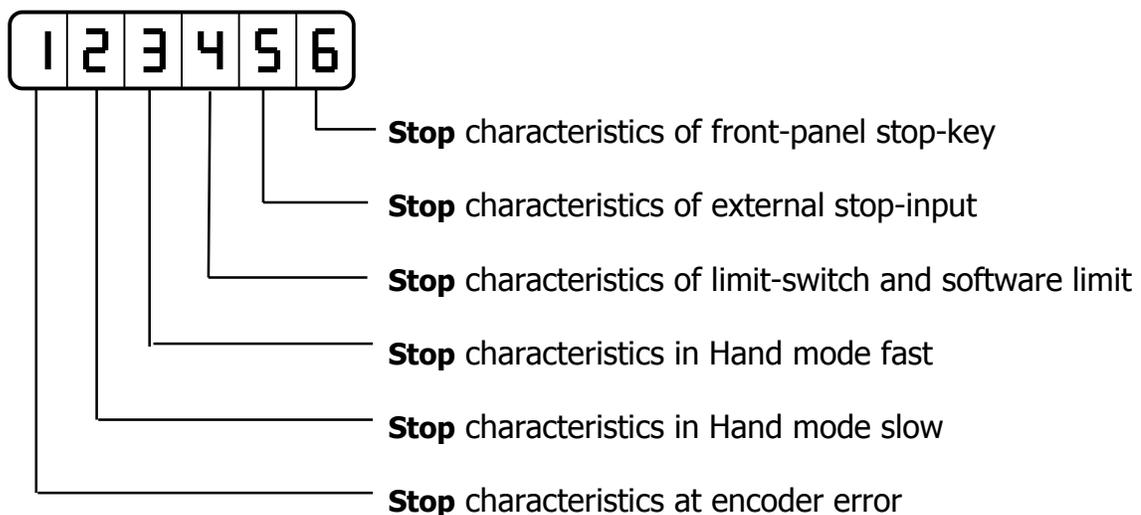Entry of any other value will automatically select 1

R57   Encoder Resolution (max 10000 pulses/revolution)

The Encoder pulses per revolution are entered in this Register. This enables the calculation of speed to be effected.

R58   Stop characteristics

This Register sets the stop characteristics of the controller in the different stop conditions.

Target Window

Stop characteristics of front-panel stop-key

Stop characteristics of external stop-input

Stop characteristics of limit-switch and software limit

Stop characteristics in Hand mode fast

Stop characteristics in Hand mode slow

Stop characteristics at encoder error

Value 0 = Stop smoothly (Ramp of R51)
Value 1 = Stop abruptly
Value 2 = Stop turn motor off
Value 3 = Stop turn motor off, after timer in Register 31 closed loop control

Parameters for closed loop Analogue control (R60-66)

R60	Speed "Hand Slow Backwards"	Button 7	in rpm
R61	Speed "Hand Fast Backwards"	Button 8	in rpm
R62	Speed "Hand Fast Forwards"	Button 9	in rpm
R63	Speed "Hand Slow Forwards"	Button NR	in rpm

R64   Setting physical direction of Manual   Buttons
R64 = xxxxx0 = Standard direction
R64 = xxxxx1 = Opposite direction

R65   Speed to "Fixed Position" (in rpm)
The Axis will move to the Fixed Position at this speed, irrespective of other settings.

R66   Acceleration (deceleration) for move to Fixed Position (in revs/sec2)
This is set irrespective of other values.

R67   Speed of going to Datum – First phase (in rpm)

R68   Speed of going to Datum – Second phase (in rpm)

R69   Speed of going to Datum in First phase, in switched speed control mode

R88   System Register 3
This Register sets further basic functions of the controller.

Target Window

Incremental error comp
0 = not active
1 = active

Start input
0 = + ve edge triggered
1 = - ve edge triggered

Option
Option
Option
Option
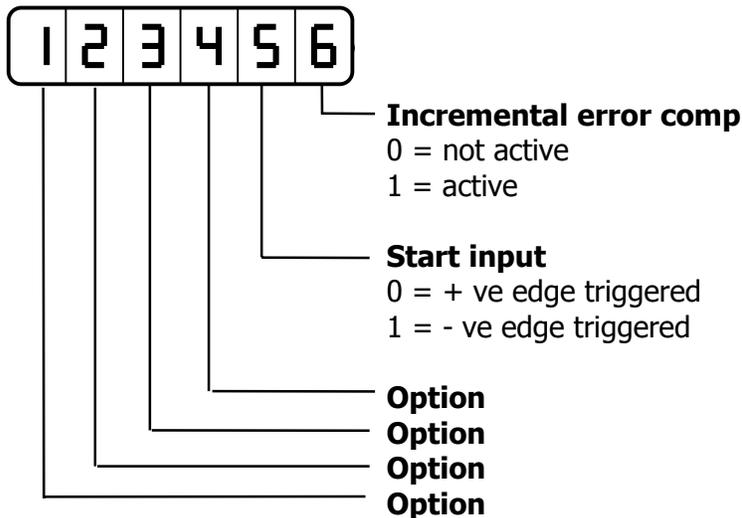
R94   "Free" Factor
Any factor value can be entered here between 0.00001 and 9.99999 and selected by R97 = xxxxx3. When the display is switched between metric/"inch", this factor will be used to change the display to secondary units.

R96   Encoder Pulse Multiplier
A factor (0.00001 to 9.9999) can be entered in this Register. The incoming pulses will be multiplied by this factor, to manipulate the display to required dimensions. If no multiplication is required, this Register must be set to 1.00000.

R97   Inch/mm conversion mode

The setting in this register activates the in inch mode, the free factor and the resolution in the inch mode can be selected. R97/6 =00000x
0 = mm operation
1 = inch operation. Resolution 1/100
2 = inch operation. Resolution 1/1000
3 = factor operation. As set in R94

R98   Security Code

Enter 250565 to unlock and change Parameters

R99   Service register

For testing at factory set-up only.

8. Offset Adjustment of Closed loop Analogue system

When the position controller is connected to the motor drive, it is possible to come "into position" with an error, due to an analogue offset voltage.

This error can be compensated for by adjusting the offset potentiometer of the drive (analogue drives).

Typical procedure is as follows :-

a) Connect up Controller and Drive

b) Set R57 (Encoder Resolution). The other Registers can be taken as default values.

c) To achieve the greatest resolution in the display, set R96 (multiplication factor) to 100000 and R56 (edge multiplier) to 4. This is regardless what you will need for final operation of the system.

d) Enter a dimension and execute a move.
If the exact position cannot be reached, then the drive offset is not correctly set.

e) Adjust the offset potentiometer in the drive until actual position equals the Target.

f) Execute several more moves in both directions and adjust offset to the optimum.

g) Check effect of offset in both directions. If correct positioning cannot be effected by the offset potentiometer, it is necessary to first make adjustments to Parameters R52-55.

9. Setting of Analogue Parameters

Initial settings :-

1. Enter Encoder Resolution in R57 (max 10000 ppr)

2. Set Edge Multiplier in R56

3. Set the desired speed in R50 (for programme and single)
   and R60-63 (for Hand) – max 10000 rpm.

   The product of Encoder Resolution and rpm should not exceed the maximum input
   frequency of the controller.

   E.g. Resolution   i   = 1000 ppr
   Max input freq.   = 10000 Hz
   Therefore rpm = $\frac{\text{f.max x 60}}{i}$ = $\frac{10000 \text{ Hz x 60}}{1000}$ = 600 rpm

4. Set the acceleration revs/sec2 in R57

   E.g.   Velocity v   = 3000 rpm
           Time t   = 5 sec
           Accel a = $\frac{v}{t}$ = $\frac{3000 \text{ rpm}}{5 \text{ sec}}$ / 60 = 10 revolutions/sec2

5. Set the Registers R52,53,54,55 to 1

6. Now position to a large Target value

7. Adjust the value of the P Term (R52) till the required top speed is achieved during the
   Move and the Axis positions without overshoot.

8. Should the demanded position not be quite reached, adjust the I Term (R53) until it
   can do so.
   NB: R55 (I Limit) must be at least as high a value as R53.

9. If the Axis overshoots, slightly reduce R55, but no lower than R53

10. If the system begins to oscillate (i.e. a too large a value of I term), then this can
    be eliminated by adding some small value of D Term (R54) to compensate.

10. Functions of the inputs (Connector St3)

St3/1   **Reset**

St3/3 & 7   **End Limits**
External limit switches can be connected Input logic is NPN i.e. input open = end limit activated St3/3 -ve end limit St3/7 +ve end limit
Fault monitoring :   End limit –ve active = 02
                        End limit +ve active = 03
N.B If these are not connected to limit switches they need to be connected Normally closed (i.e. linked out).

St3/4   **External Start input**
The input is edge triggered Logic : opening or closing can be selected by R88/5.

St3/5   **Incremental – ve**
The Axis will position in incremental, towards zero, with this input active.

St3/6   **Incremental + ve**
The Axis will position in incremental, towards maximum, with this input active.
The above two inputs have priority over the software selection in R18/3 and R18/4. In programme mode. The input ST3/6 also needs to be closed.

St3/8   **Datum Setting**
If 0 or 1 is set in R8/3, this input is active.
R8 = xx0xxx Datum to R7
    = xx1xxx Datum to Target selected

St3/9   **PE**

St3/11   **+24V**

St3/14   **External Stop**
Input logic is NPN i.e. Input open = stop active (no positioning possible)
Should a start signal be given, the Fault 07 will be displayed.
Input closed = Stop inactive (Positioning possible).
Stop input is also active in Hand operation.

St3/16   **Quantity Adding/Subtracting**
Each pulse of this input will increment or decrement the counter.

St3/18   **Retract**
If R18 = x0xxxx   move to position "Actual + R5"
         x1xxxx   move to position set in R5

St3/19   **Fixed Position**
Activating this input starts the Axis to move to fixed position set in R25.
Speed and acceleration of this move can be set independently into R65 and R66.

St3/23   **0V**

11. Functions of the Outputs

St5/1-4   **Run Signals**
The functions are selectable. See page 20/21

St5/5   **Single Operation**
This output is set when Single is selected

St5/6   **Hand Operation**
This output is set when Hand is selected

St5/7   **Going to Datum**
If this feature is selected in R8/3, then on activating start, this output is set.
It resets when datum cycle is complete.

St5/9   **PE**

St5/11   **0V**

St5/14   **Position Reached**
Signals that position has been reached by pulsed or latched output.
If R9 is selected to zero, the output is latched i.e. "Axis in position". And is on
until next move commences. The output is set when Actual Position = Target
Position +/- Tolerance Window R12. Should a value (0.1 to 9.9 sec) be set in R9,
the output becomes a pulse of that time when position is reached.

St5/15   **Positioning / Drive enable**
This output will switch on whilst any of the motion control outputs are on.
It will stay on until timer R29 has timed out after all of the motion control
outputs

St5/16   **Quantity Reached**
Signals that the quantity has been reached by a pulse. The time is set in R11.
Quantity subtracting : when quantity = 0
Quantity adding   : when required quantity is reached

St5/17   **Programme End**
In programme mode, this output pulses at the end of the program. The output
time is set in R30.

St5/18-21   **Auxiliary Functions**
There are 10 Auxiliary functions (0-9). These outputs are binary coded.
The Operator sets the Auxiliary functions in decimal. The coded outputs are set, on
the first start of each address line, and stay energised until the next address line is
started.
St5/18 = 2(0)
St5/19 = 2(1)
St5/20 = 2(2)
St5/21 = 2(3)

St5/23   **+24V**

12. Connections

St5   Output Signals (Push Pull)

1	Creep	These run signals are confi-
2	Slow	gurable in a number of ways
3	Fast	see page 20/21 (these sig-
4	Reverse	nals are only for R8/5=0)
5	Single selected	
6	Hand selected	
7	Going to datum	
9	E	
10	E	
11	Common 0v potential for outputs	
14	Position reached/in position	
15	Drive enable/Positioning	
16	Quantity reached pulse	
17	Programme end	
24	+24 VDC out	

St7   RS232   Serial   communication
(Option)

1	RX
2	TX
3	0V

St8   Analogue output

7	Output +/-10 V
8	0 V
9	Earth/ Screen

St1   Encoder Input

1	0V of 24 V
2	+ 24 VDC
3	A- channel
4	B- channel
5	Earth
6	A- channel inverted (only with Line driver)
7	B- channel inverted (only with Line driver)
8	Index signal
9	Index signal inverted (only with Line driver)

St3   Input Signals (NPN)

1	Reset
2	-
3	End limit switch -ve
4	Start
5	Incremental -ve
6	Incremental +ve
7	End limit switch +ve
8	Datum/Calibration
9	Earth
10	Earth
11	+24 VDC out
14	Stop
15	-
16	Quantity input
18	Retract
19	Go to Fixed Position (PID only)
20	-
21	-
23	Input common 0v

St9   Power supply (from NG13.0)

1	24 VDC
2	0 V of 24 V
3	Earth

St9   Power   supply   230/115   VAC
(Option)

1	230/115 VAC - 14VA
2	230/115 VAC
3	PE Earth & Screens

12.1 Terminal layout
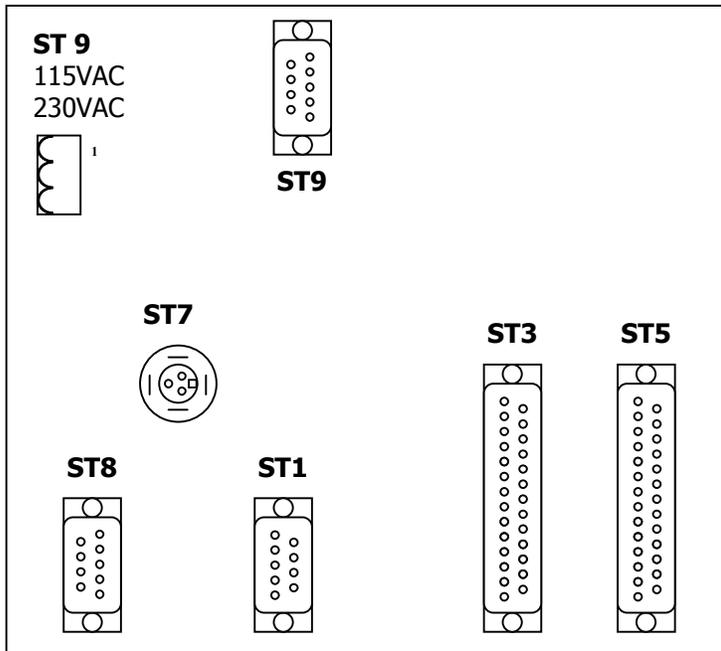
St1   Encoder Input
St3   Input Signals
St5   Output Signals
St7   Serial com's
St8   Analogue Signals
St9   Power supply (from NG13.0) / ore 115/230 VAC

13. Technical Data

Power Supply	+24 VDC/ 230/115 VAC 50/60 Hz (+/- 10 %)
Consumption	500 mA / 24VDC max
Encoder supply	+24 VDC - 130 mA max
Input Signals	PNP negative logic : connect inputs to 24V (option NPN – if specified at order stage only) minimum time of input signal : 300 ms input current : 10 mA max
Output Signals	Push Pull output current 50 mA max per channel
Memory	EEPROM minimum 5 years
Connectors	D-Sub and round-connectors (RS232)
Display	7 segment LED 10 mm high
Hardware	16 Bit SMD microprocessor with 128K E-Prom
System accuracy	+/- 1 increment
Count Frequency	20 KHz (higher on request at order stage) i.e. with 0.1 mm resolution, it gives 120 m/min
Enclosure	Black metal, for fitting into control panels W x H x D = 144 mm x 144 mm x 80 mm plus 30 mm for connectors
Cut-out	W x H = 138 x 138 mm
Ambient temperature	0… 45 ° C

Power Supply NG13.0

Input	230 VAC or 115 VAC +/- 10 % 50/60 Hz 40 VA
Outputs	9v 400 mA and 24v 600 mA (unregulated)
.	

14. Installation Hints

Elgo Electric controllers are constructed to the latest standards of technology and protected against noise.

To enable the controller to operate successfully, the following instructions must be carried out.

Location   The unit must not be mounted in vicinity of high inductive or capacitive powers or static electricity.

Power Supply: For 230v single phase supply, avoid using the same feed as to motors   or contactors. Otherwise fit a Filter.

Cable: All low voltage cables must be run separately from power cables.

Screening: All external signal cables must be screened
1. Encoder cable
2. Input signal cable

All screens must be connected to a common earth point.

NB: Do not connect zero line to earth

Suppression: To avoid electronic noise. Suppress all coils in the cabinet and on Machine.

1. RC network for ac coils (e.g. 0.1 micro F+ 100 ohms)
2. Freewheel diode for dc coils
3. RC or similar suppressor for motor power lines and Brakes.

15. Type designation

P 85 1 1 – XXX- XXX- 0 – PXXXXXX

P = Position Controller

Series
P8511 without program memory

Programme Memory
　　1 = none

Number of Axes

Construction
　　000 = standard
　　001 = 1st special version
　　etc.

Supply voltage
　　024 = 24 V DC
　　115 = 115 V AC
　　230 = 230 V AC

Encoder input
　　0 = A/B 24V/24V 20KHz PNP
　　1 = A/B/0 24V24V 20KHz PNP
　　2 = 5 V line receiver
　　3 = 5V line receiver with index input
　　8 = A/B 24V /24 neg. logic NPN

Special Features
　　P = Analogue closed loop
　　R = Relay output
　　EN = input NPN (including marker)
　　S= Serial communication link RS232

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. Reprint, duplication and translation, even in extracts, are only allowed with a written authorization by the company ELGO Electric GmbH. We constantly strive for improving our products, therefore we keep all rights reserved for any technical modifications without any notice.

ELGO Electric does not assume any liability for possible errors or mistakes.

The guarantee period is one calendar year 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.!

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