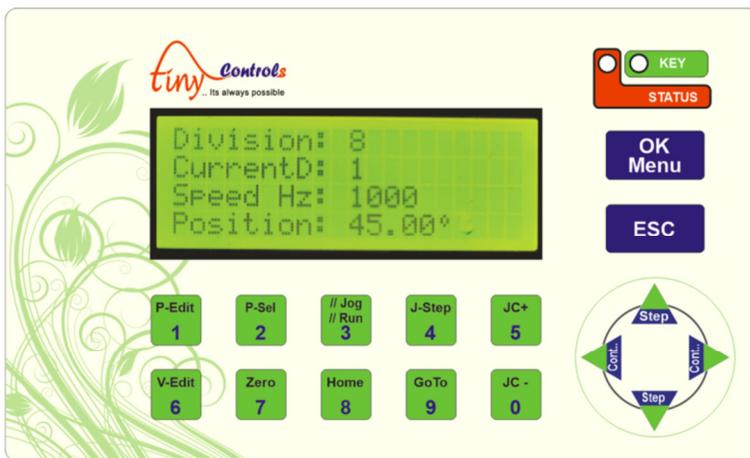




Single Axis Motion Controller – TNC-G01



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(Single Axis Indexing Controller)
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This manual contains information for installing and operating the following product:

- TNC-G01 , Single Axis Indexing Controller

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General Description

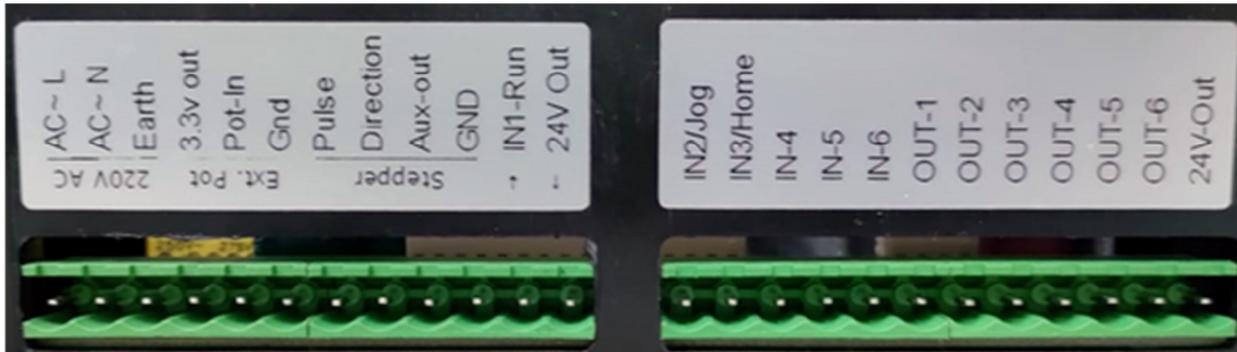
TNC-G01 is a programmable motion controller intended to be used in rotary table applications. It can be used to control continuous rotary motion or in Indexing applications.

In Indexing mode (i.e. division mode), there is no accumulation of error and the error is distributed along whole circular motion if the programmed movement cannot be achieved exactly due step angle not exactly divisible.

Specifications

- **Supply Voltage:** 90V to 250V AC 50Hz/60Hz
- **Pulse Rate:** 100 KHz
- **Overall Size:** 165mm x 102mm x 76 mm
- **Mounting:** Panel Cutout 155mmx92mm
- **Inputs:** Four NPN NO Inputs, 1 Analog Potentiometer Input
- **Outputs:** Three Outputs for Motors Step, Direction and Reserved
Six Open collector 24V relay driver
- **Display:** 20x4 Line alphanumeric
- **Temperature:** 55 Degree C Max operation temperature

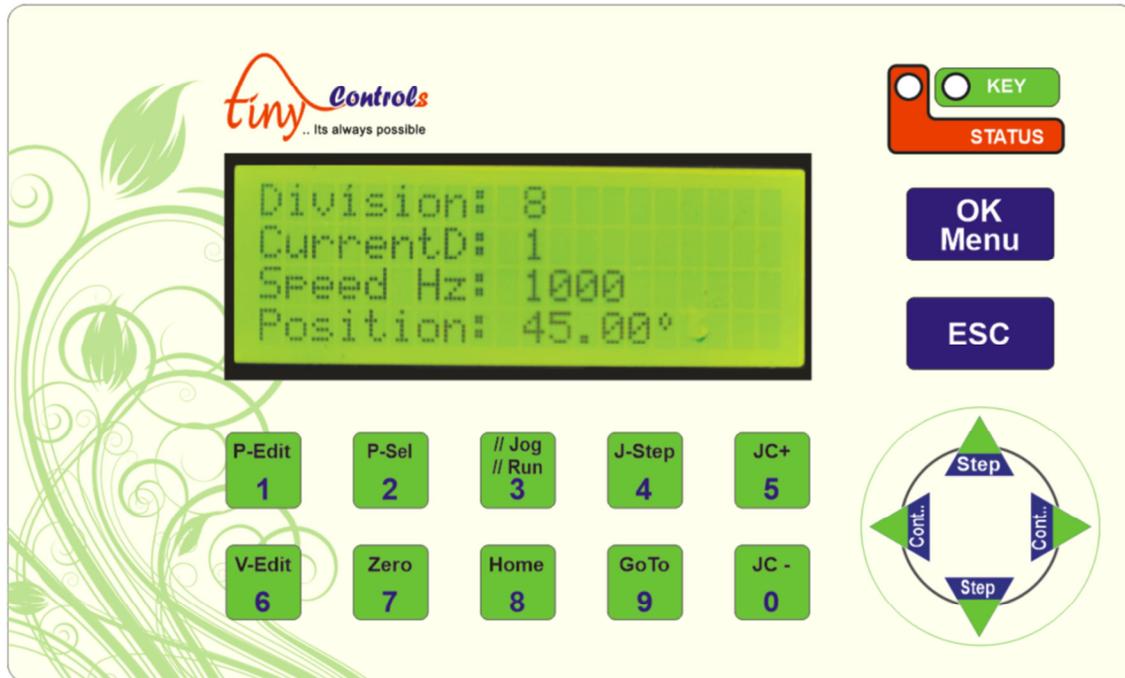
Connection



Pin Number (From Left to Right)

1-3	Power Supply Input (90V to 260V) AC 50Hz/60Hz & Earth
4-6	External Potentiometer Connection
7-10	Step, Direction, Reserved and Gnd Connection for Motor Driver
11	In1 Active Low Program-Run/Jog Run
12	24VDC supply output, can be used for relays/Sensor etc, Max current 200 mA
13	In2 Active Low Jog Run
14	In3 General Purpose NPN NO inputs, can be used for homing as well
15-17	General Purpose NPN NO inputs
18-23	OUT1 to OUT6 Open Collector Driver for Driving Relay or Controller Inputs
24	24VDC supply output, can be used for relays/Sensor etc, Max current 200 mA

Keypad



Numeric keys are used to enter values in editing or menu settings, alternate functions assigned to the numeric keys are explained below:

- **P-Sel** : Six programs are be saved in the controller, using this key to load a program (1 to 6)
- **P-Edit** : Selected program can be edited, use this key to enter program editing mode.
- **V-Edit** : Variables shown in "Run" mode can be edited when the controller is in program mode and the program is not executing , use this key to enter editing mode.
- **//Run//Jog** : This key toggles between Jog and program run mode.
- **Zero** : In jog mode, this key resets the position to zero.
- **Home** : Initiate homing cycle, "home" sensor input is used for homing and position is set to zero after completion.
- **Jstep** : In Jog mode, sets the value of step movement.
- **Goto** : In Jog mode, sets the position to move the motor
- **JC+** : In Jog mode, Increase the motor speed by 10%
- **JC-** : In Jog mode, decrease the motor speed by 10%
- **Step (Up)** : Moves the motor in +ve direction by one "Jstep".
- **Step (Down)** : Moves the motor in iv direction by one "Jstep".
- **Cont.. (Left)** : Moves motor continuously at set speed in -ve Direction.
- **Cont.. (Right)** : Moves motor continuously at set speed in +ve Direction.
- **OK/Menu** : Confirms values, Long press to enter Setting menu.
- **ESC** : Cancel values, stops some movement, cancel homing cycle etc.

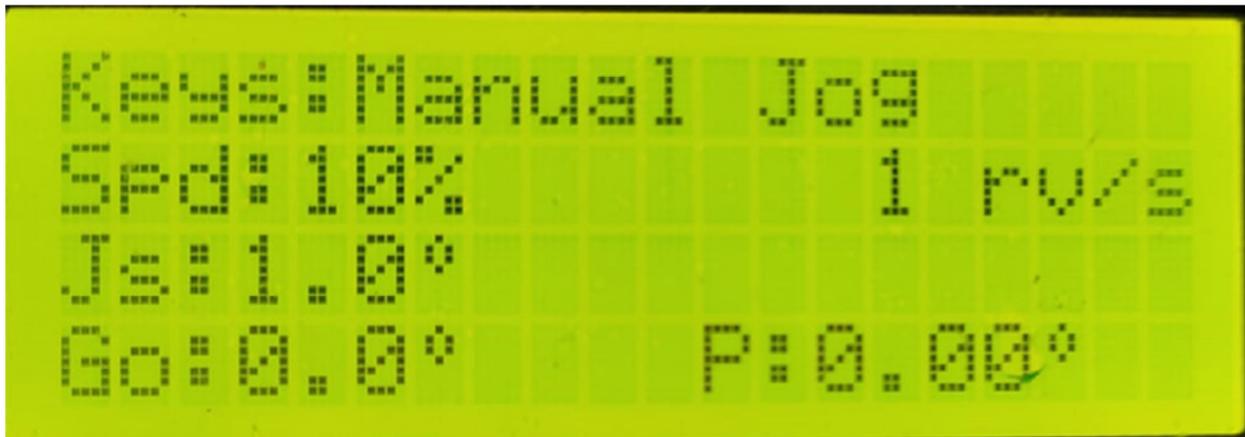
Operation

//Run//Jog : This key toggles between “Jog” and “Run” mode.

Controller works in two modes:

- 1) RUN (Program Run)
- 2) JOG Mode

In Jog mode, the Jog screen is shown as below



- “Up/Down” keys moves the motor by angle specified in “Js” variable, in forward/reverse direction respectively
- “Left/Right” keys moves the motor for continuously in forward/reverse direction respectively
- “Goto” key edits **and moves the motor** to a specified angle position
- “JC+” key increases motor speed by in 10% increments
- “JC-” key increases motor speed by in 10% increments
- “J-step” key edits the Js (step size) value
- “Goto” key edits **and moves the motor** to a specified angle position
- “Zero” key resets the current position to zero but **doesn't move the motor**
- “Home” key is used to initiate homing cycle using input “Home”
- See advance feature section for “V-Edit” function

Following submodes are available in Jog Mode:

- **“Keys: Manual Jog”** – use “Up/Down” keys for step movement, “Left/Right” keys for continuous movement.
- **“Inputs: CW priority”** - “IN1 & IN2” rotate motor in CW/CCW direction, if both inputs are active CW direction input takes priority.
- **“Inputs: CCW priority”** - “IN1 & IN2” rotate motor in CW/CCW direction, if both inputs are active CCW direction input takes priority.
- **“Inputs: Start/Start”** - “IN1 & IN2” triggers motion start CW/CCW direction respectively, to stop motor same input is used to triggers the stop action.
- **“Inputs: Start/Stop”** - “IN1 & IN2” inputs triggers Start/Stop actions, default direction set in the setting menu is used.
- **“Inputs: Step mode”** - “IN1 & IN2” inputs triggers “Step” movement in CW/CCW directions respectively.

Program Command / Program Editing

After the password is entered, press "Ok" to edit the currently selected program (there are 6 programs)



Arrow mark shows the current command being edited, use "left/right keys to scroll through the available commands, use ok to edit the parameters of the command.

- Long press "1" inserts a new "NOP" (No operation) command above the current command, this NOP command then can be edited using left/right keys same as above.
- Long press "0" to delete a command at the current location.
- Commands after the "PrgEnd" command are ignored.

Settings

Following settings can be changed from this menu:

SN	Setting Name	Description	Range / Allowed Values / Selectable Options
1	<i>Motor Dir</i>	<i>Motor Default Direction</i>	<i>CW or CCW</i>
2	<i>Home Dir</i>	<i>Motor Homing Direction</i>	<i>CW or CCW</i>
3	<i>Gearing</i>	<i>Gear Ratio for Motor</i>	<i>0.01 to 9999.99</i>
4	<i>Stp/mm</i>	<i>Steps per mm for Motor</i>	<i>1 to 99999</i>
5	<i>Stp/Rot</i>	<i>Steps per Rotation for Motor</i>	<i>1 to 99999</i>
6	<i>Stp/Sec</i>	<i>Speed Steps per Sec for Motor</i>	<i>1 to 99999</i>
7	<i>Accel</i>	<i>Acceleration for Motor</i>	<i>1 to 99999</i>
8	<i>HomSped</i>	<i>Motor Homing Speed</i>	<i>1 to 99999 Steps per Second (Limited to Motor Speed)</i>
9	<i>HomAccel</i>	<i>Motor Homing Acceleration</i>	<i>1 to 99999</i>
10	<i>JogSped</i>	<i>Motor Jogging Speed</i>	<i>1 to 99999 Steps per Second (Limited to Motor Speed)</i>
11	<i>OutEnable</i>	<i>In Indexing mode outputs are toggle as explained later if enabled</i>	
12	<i>ClampDly1</i>	<i>In Indexing mode outputs are toggle as explained later if enabled</i>	
13	<i>ClampDly2</i>	<i>In Indexing mode outputs are toggle as explained later if enabled</i>	
14	<i>AckDly</i>		
15	<i>ExtPot</i>	<i>External Potentiometer Enable</i>	<i>Used in Continuous Mode for speed control</i>
16	<i>FactoryRst</i>	<i>Reset Settings or Programs</i>	<i>Select "Settings" or "Programs" to defaults</i>
17	<i>Ucnt</i>	<i>Lifetime Motion Counter</i>	<i>Displays number of programs executed so far (Not resettable by user)</i>
18	<i>TNC-G01 V</i>	<i>Displays Software version</i>	<i>Only of information about the controller</i>

Executing the Program

The selected program number in Settings is executed by asserting IN1-Run input to the controller, if the input is removed program is paused and can be resumed by again giving the IN1-Run input.

Supported Commands

SN	Command	Parameters Supported	Comments
1	Nop	No Operation	Place holder command, to be changed into other command at later stage, or for adding a very small delay in the program.
2	Dir CW , Dir CCW		Set motor direction, affects all future moves.
3	Speed	S, 1 – 99999	Set motor Speed (rpm) for future moves
4	Accel	1 - 99999	Set motor acceleration / deceleration
5	SetDiv	W, 1 – 99999	Set number of divisions per rotation for Rotary. for future “MvDiv” (move by division) moves,
6	MvDiv	D 0.01 – 9999.99	Moves motor by selected Divisions out of total divisions set for per rotation (see example) Please enter whole number only, rounded off to whole number if any decimal value is entered
7	Rst Pos		Resets internal motor position counter to zero, does not move a motor.
8	MT On		Start continuous motion for Motor
9	MT Off		Stops continuous motion for Motor
10	Home		Initiate “Homing” sequence for the motor. “IN3-Home” is sensor input is used for homing
11	Goto	D, 0.01 – 9999.99	Absolute motor movement for motor.
12	Waitfor	IN3, IN4, IN5, IN6 AROWKEY MOTOR	Program is paused and waits for some event : - Wait for one Input (3~6) to be triggered - Wait for an “Arrow Key” to be pressed - Wait till for move to be completed
13	Wait_mS	W, 1 – 99999	Wait for W / time (in millisceonds)
14	Count++		Increment counter displayed on the screen
15	Out Low	OUT1, OUT2, OUT3 OUT4, OUT5, OUT6	Activate Corresponding Output.
16	Out Hig	OUT1, OUT2, OUT3 OUT4, OUT5, OUT6	Deactivates Corresponding Output.
17	In=>Out	I4->O1, I4->O2, I4->O3 I5->O1, I5->O2, I5->O3 I6->O1, I6->O2, I6->O3	Copies/Latches an input state to output pin Example “I4>O1” copies Input 4 state to Output 1
18	LoopFor	L, 1 - 99999	Repeat command till next “Loopend” See Example
19	LoopEnd		Used along with “LoopFor” (See Example)
20	BlokSkp	IN3, IN4, IN5, IN6	Conditional block Skip command (See Example)
21	BlokRun	IN3, IN4, IN5, IN6	Conditional block Run command (See Example)
22	BlokEnd		Used along with “BlokSkp” or “BlokRun” command (See Example)
23	PrgmEnd	Stop Repeat	Marks Program End “Repeat” parameter makes program to reset and repeat over from the beginning “Stop” makes program to run only once

Program Structure and Programs Example

This section explains program structure and later shows small sections of code for achieving a particular function. These small fragments can be combined into a larger program to realize complex custom machines.

Also see next where six default programs (that comes factory programmed) are explained.

Program Structure:

Command 1

Command 2

Command 3

LoopFor XX

Command 4

Command 5

Loop End

Command 8

PrgmEnd Repeat

- Commands are executed from top to bottom
- LoopFor command repeats the command in the “LoopFor” and “Loop End” block, XX times
- In the example on the left :
 - o Command 1, 2, 3 executed once
 - o Command 4,5 executed XX times
 - o Command 8 is executed once, after Loop ends
 - o PrgmEnd with “Repeat” then repeats the whole program again, forever

Example Program :

```
Out Hig    OUT1
Wait_ms    500
Out Low    OUT1
Out Hig    OUT2
Wait_ms    500
Out Low    OUT2
Out Hig    OUT3
Wait_ms    500
Out Low    OUT3
Out Hig    OUT4
Wait_ms    500
Out Low    OUT4
Out Hig    OUT5
Wait_ms    500
Out Low    OUT5
Out Hig    OUT6
Wait_ms    500
Out Low    OUT6
PrgmEnd    Repeat
```

Above program turn ON the outputs sequentially for 500mS endlessly, can be used for testing outputs.

Example Program :

```
In=>OUT    I4->O1
In=>OUT    I5->O2
In=>OUT    I6->O3
PrgmEnd    Repeat
```

Above program copies input status to the outputs, I4,I5 & I6 inputs are copied to the O4,I5 & I6 outputs respectively.

Example Program :

```
Speed      20000
Accel      1024
Out Hig    OUT1
MovDeg     1.00
Waitfor    MOTOR
Out Low    OUT1
Out Hig    OUT2
Wait_ms    500
Out Low    OUT2
PrgmEnd    Repeat
```

Above program:

- Sets Motor Speed and Acceleration
- Turn ON output 1
- Move motor by 1 degree and wait for movement to end
- Turns OFF output1 and turns ON output 2
- Waits for 500mS and turns OFF output 2
- Repeats Above sequence

Default Program4:

```
Speed      S
Accel      1024

BlokRun    IN3
Out Hig    OUT3
Dir CW
Loopfor    3
Movmm      1.00
LoopEnd
Waitfor    MOTOR
Out Low    OUT3
BlokEnd

BlokRun    IN4
Out Hig    OUT4
Dir CW
Loopfor    4
Movmm      1.00
LoopEnd
Waitfor    MOTOR
Out Low    OUT4
BlokEnd

BlokRun    IN5
Out Hig    OUT5
Dir CW
Loopfor    5
Movmm      1.00
LoopEnd
Waitfor    MOTOR
Out Low    OUT5
BlokEnd

PrgmEnd    Repeat
```

Above program illustrate Nesting of Loops for further complex functionality, explanation coming soon...

Example Program

```
Speed      S
Accel      1024
SetDiv     W
    BlokRun  IN3
    Dir CW
    MvDiv    D
    Waitfor  MOTOR
    BlokEnd

    BlokRun  IN4
    Dir CCW
    MvDiv    D
    Waitfor  MOTOR
    BlokEnd
PrgmEnd    Repeat
```

This is a practical program that can be used for **indexing application** as it is or can be customized further. In defaults state it works as below:

- Motor speed is set from variable "S"
- Acceleration is set to 1024
- Total number of Indexing Divisions are set from variable "W"
- First block of code between "BlokRun" and "BlokEnd" is executed if Input 3 is found **active**. If Input 3 is found **inactive** this block is skipped otherwise following 3 commands are executed: **1)** Motor direction is set to "Clockwise" **2)** Motor is moved by number of division set in variable "D" and **3)** Waits till moment is completed.
- Second block of code between "BlokRun" and "BlokEnd" is executed if Input 4 is found **active**. If Input 4 is found **inactive** this block is skipped otherwise following 3 commands are executed: **1)** Motor direction is set to "Counter Clockwise" **2)** Motor is moved by number of division set in variable "D" and **3)** Waits till moment is completed.
- Program is repeated.

Effectively above indexing program takes 2 inputs (IN3 and IN4) and INDEX the motor in clockwise or counter clockwise direction respectively. Eg if variable "W" is set to 4 and variable "D" is set to 1, on each input IN3 motor will move by 90 degrees clockwise. Or in each input on IN4 motor will move 90 degrees reverse direction.

Special Inbuilt Indexing program number "5"

In Run mode, the controller simply does the Indexing function:

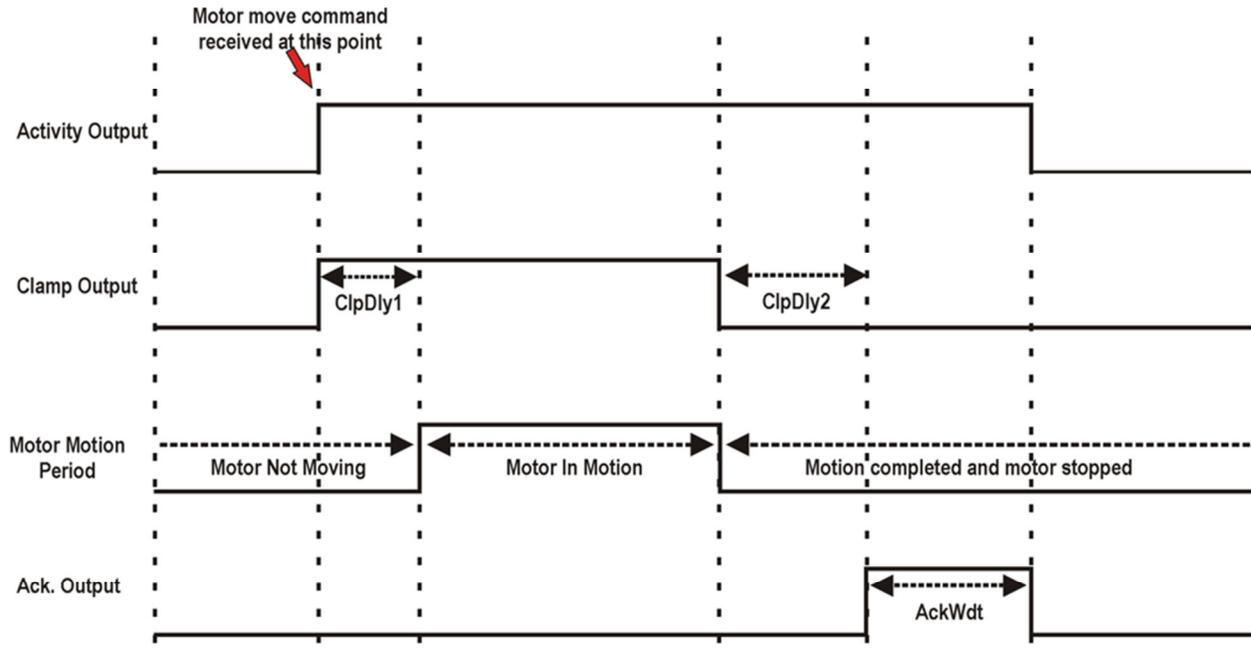
- *Use V-Edit key to edit "Division" and "Speed Hz" variables*
- *"Division" is the number of parts you want to divide the whole circle, example below shows its set to "8"*
- *"Speed Hz" is the Pulse frequency for the motor driver*
- *Acceleration configuration can be set in "Settings" Menu*
- *Note : The actual movement of motor honors the "Gear Ratio" in the "Setting" Menu*
- *"CurrentD" shows the current position in division unit*
- *"Position" shows the current position in degree unit*
- *Use "Up" /"Down" keys to index by one division in the forward / reverse direction*
- *See advanced function section for using inputs for indexing*



There are 3 pairs of outputs available

- ***Clamp & Clamp :*** *Can be used for activation of motor brakes*
- ***Activity & Activity:*** *Can be used for Job clamping in automated process*
- ***Ack. & Act.:*** *Can be used to signal to other system for further operation after indexing*
- ***Each of above pairs are complementary, for example when Clamp is High, Clamp will be low and vice versa***

Output state flow is shown in following diagram and the three delay parameters named “ClpDly1”, “ClpDly2” and “AckWdt” can be set in the “Settings menu.



Settings Menu

Long press OK key to enter Setting menu, default password is "2626"



Following settings can be changed from this menu:

SN	Setting Name	Description	Range / Allowed Values / Selectable Options
1	Motor Dir	Motor Default Direction	Normal or Invert
2	Home Dir	Motor Homing Direction	Normal or Invert
3	Gearing	Gear Ratio for Motor	0.01 to 9999.99
4	Stp/Rot	Steps per Rotation for Motor	1 to 99999
5	Stp/Sec	Speed Steps per Sec for Motor	1 to 99999
6	Accel	Acceleration for Motor	1 to 99999
7	HomSped	Motor Homing Speed	1 to 99999 Steps per Second (Limited to Motor Speed)
8	HomAccel	Motor Homing Acceleration	1 to 99999
9	JogSped	Motor Jogging Speed	1 to 99999 Steps per Second (Limited to Motor Speed)
10	ClpDly1 ms	Camping Delay	1 to 99999 in mS
11	ClpDly2 ms	Unclamping Delay	1 to 99999 in mS
12	AckWdt ms	Ack. Output pulse width	1 to 99999 in mS
13	ExtPot	External Potentiometer Enable	Enable or Disable Used in Continuous Mode for speed control
14	FactoryRst	Reset Settings or Programs	Select "Settings" or "Programs" to defaults
15	Ucnt	Lifetime Motion Counter	Displays number of programs executed so far (Not resettable by user)
16	TNC-G01 V	Displays Software version	Only of information about the controller

