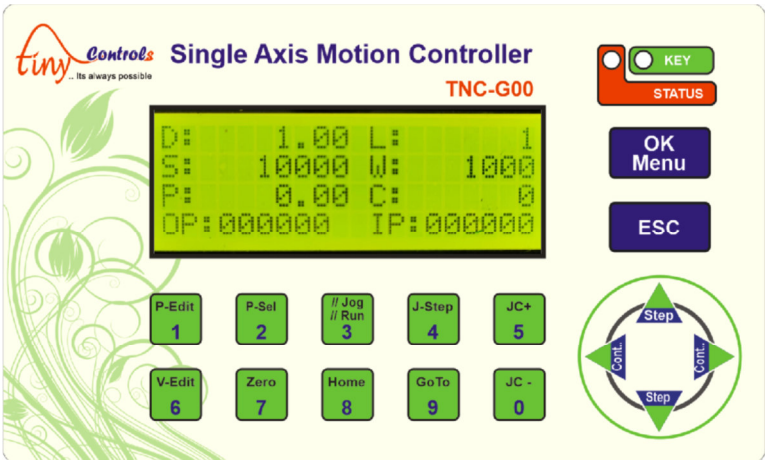
Single Axis Motion Controller – TNC-G00



Document: Operation Manual
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(Single Axis Motor Controller)
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This manual contains information for installing and operating the following product:

- TNC-G00 , Single Axis Programmable General Purpose Motion Controller

TINY CONTROLS PRIVATE LIMITED
B-17/a, NISHAT PARK, KAKROLA, NEW DELHI, INDIA – 110078
WEB: http://www.tinycontrols.com
PHONE: +91-991-119-3210

GENERAL DESCRIPTION

TNC-G00 is programmable motion controller intended to replace PLC and HMI in many applications at lower cost. Controller supports linear as well as rotary mode. Rotary or Division command is intended to control rotary tables but can also be used to perform many custom operations. In circular motion (i.e. division mode), there is no accumulation of error (i.e. the error is distributed along whole circle motion if the programmed motion cannot be achieved exactly due step angle not exactly divisible).

As NESTED LOOPS are also supported, the programs can do a lot of complex operations.

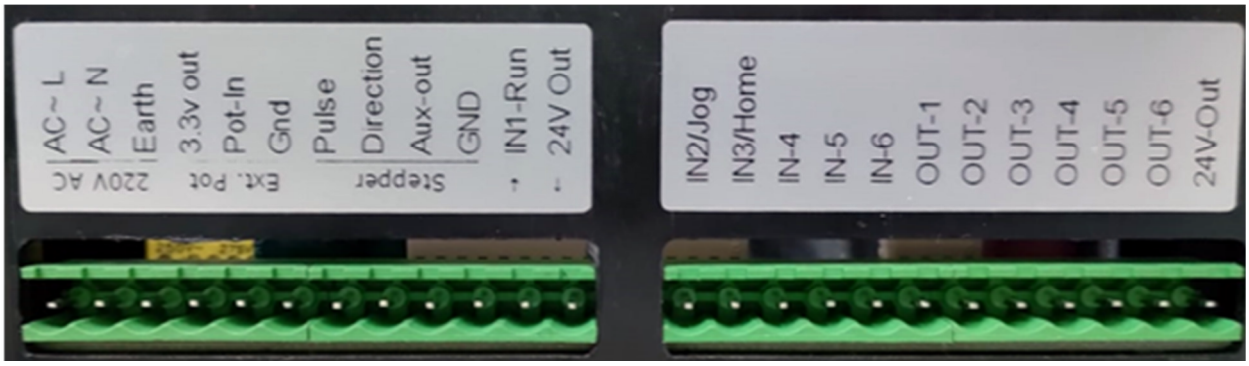
The following commands are supported: (see Program edit section for details)

Motion Setup: Dir CW, Dir CCW, Speed, Accel, SetDiv
Motion Commands: Movmm, MovDiv, Goto, Motor on, Motor off
Control Commands: Waitfor [INx, Mt, Arrowkey], BlokSkp[INx], SKP End, BlokRun[INx],
I/O Manipulation: OutLow[OUTx], OutHigh[OUTx], In=>Out[Ix->Ox]
Recursion: PrgmEnd[Stop, Repeat], LoopFor[count,L], LoopEnd
Dwell Command : Wait_mS
Process Counting: Count++
Home Commands: Home
No Operation: NOP
Reset Position: Rst Pos

SPECIFICATION/FEATURES:

- **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:** *6 NPN NO Inputs, 1 Analog Potetiometer Input
- **Outputs:** 3 Outputs for Motors Step, Direction and Reserved
  6 Open collector 24V relay driver
- **Display:** 20x4 Line alphanumeric
- **Temperature:** 55 Degree C Max operation temperature

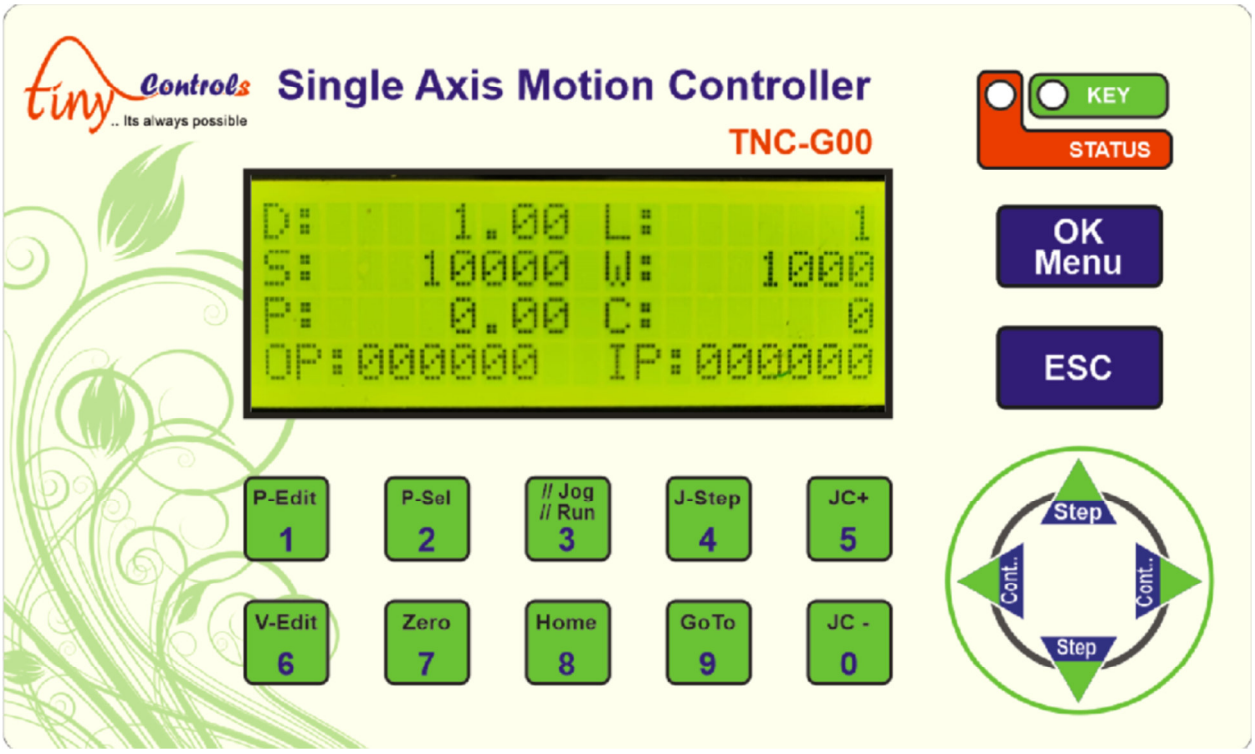
Connection



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.*

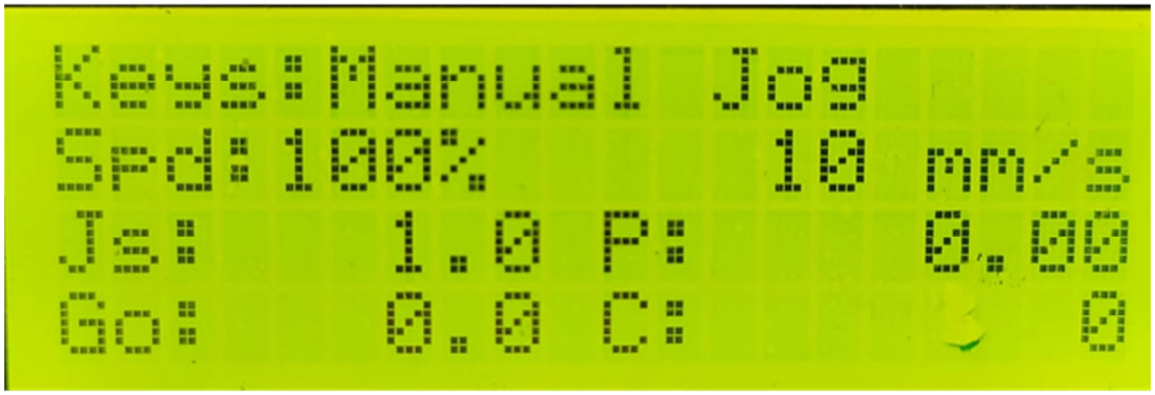
ESC : *Cancel values, stops some movement, cancel homing cycle etc.*

Operation

Controller works in two modes:

1) *JOG Mode*
2) *RUN (program Mode)*
3) ***//Run//Jog :*** *This key toggles between Jog and program run mode.*

Jog mode is basic mode and doesn't need any programing. Jog mode screens is shown below.



Jogging can be controlled/performed using "arrow keys" or using Inputs "IN1 & IN2". First line shows the mode used for operation and can be selected by ***"V-edit"*** *key.*

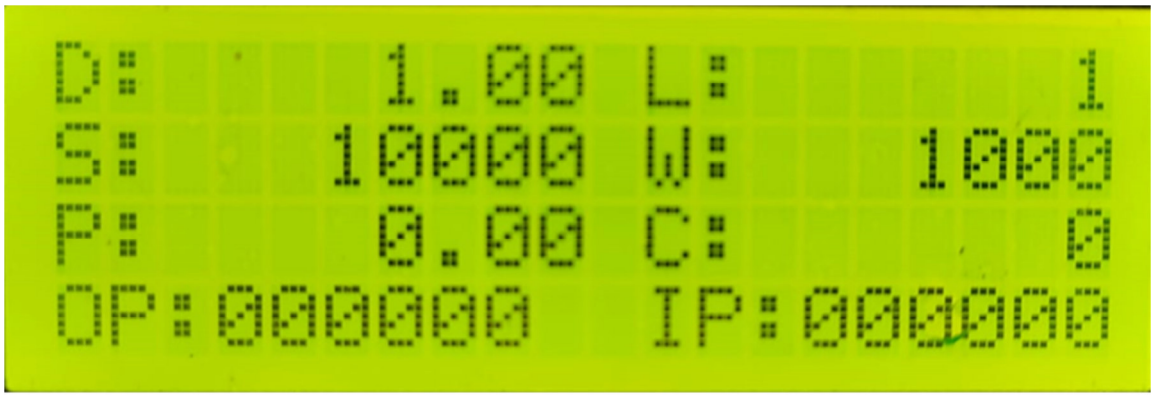
Unit is displayed as mm/s for Linear mode and degree/s for Rotary mode.

Following modes are available:

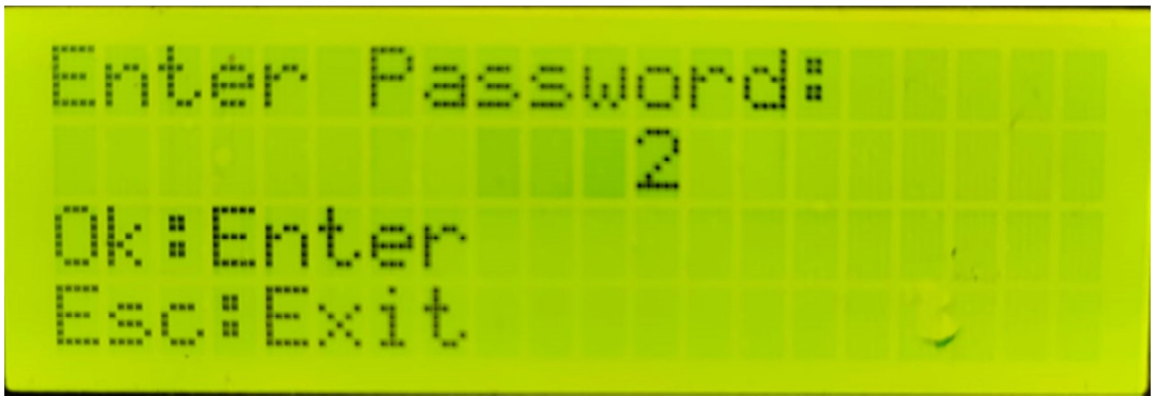
- ***"Keys: Manual Jog"*** *– use "Up/Down" keys for step movement, "Left/Right" keys for continuous movement.*
- ***"Inputs: CW priority"*** *- "IN1 & IN2" rotate motor in CW/CCW direction, if both inputs are active CW direction input takes priority.*
- *"**Inputs: CCW priority"** - "IN1 & IN2" rotate 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.*

In Run mode, the controller executes the selected program, use V-Edit key to edit the variables on run screen; these values are reflected in program if used.



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



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	Type	Motor Type	Linear or Rotary
2	Motor Dir	Motor Default Direction	CW or CCW
3	Home Dir	Motor Homing Direction	CW or CCW
4	Gearing	Gear Ratio for Motor	0.01 to 9999.99
5	Stp/mm	Steps per mm for Motor	1 to 99999
6	Stp/Rot	Steps per Rotation for Motor	1 to 99999
7	Stp/Sec	Speed Steps per Sec for Motor	1 to 99999
8	Accel	Acceleration for Motor	1 to 99999
9	HomSped	Motor Homing Speed	1 to 99999 Steps per Second (Limited to Motor Speed)
10	HomAccel	Motor Homing Acceleration	1 to 99999
11	JogSped	Motor Jogging Speed	1 to 99999 Steps per Second (Limited to Motor Speed)
12	ExtPot	External Potentiometer Enable	Used in Continuous Mode for speed control
13	FactoryRst	Reset Settings or Programs	Select “Settings” or “Programs” to defaults
14	Ucnt	Lifetime Motion Counter	Displays number of programs executed so far (Not resettable by user)
15	TNC-G00 V	Displays Software version	Only of information about the controller

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 (Steps/Sec) 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	Movmm	D 0.01 – 9999.99	*Moves motor by mm
7	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
8	Rst Pos		Resets internal motor position counter to zero, does not move a motor.
9	MT On		Start continuous motion for Motor
10	MT Off		Stops continuous motion for Motor
11	Home		Initiate "Homing" sequence for the motor. "IN3-Home" is sensor input is used for homing
12	Goto	D, 0.01 – 9999.99	Absolute motor movement for motor.
13	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
14	Wait_mS	W, 1 – 99999	Wait for W / time (in millisceonds)
15	Count++		Increment counter displayed on the screen
16	Out Low	OUT1, OUT2, OUT3 OUT4, OUT5, OUT6	Activate Corresponding Output.
17	Out Hig	OUT1, OUT2, OUT3 OUT4, OUT5, OUT6	Deactivates Corresponding Output.
18	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
19	LoopFor	L , 1 - 99999	Repeat command till next "Loopend" See Example
20	LoopEnd		Used along with "LoopFor" (See Example)
21	BlokSkp	IN3, IN4, IN5, IN6	Conditional block Skip command (See Example)
22	BlokRun	IN3, IN4, IN5, IN6	Conditional block Run command (See Example)
23	BlokEnd		Used along with "BlokSkp" or "BlokRun" command (See Example)
24	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 :
    - Command 1, 2, 3 executed once
    - Command 4,5 executed XX times
    - Command 8 is executed once, after Loop ends
    - PrgmEnd with "Repeat" then repeats the whole program again, forever

Factory Programmed Programs

This section explains six default programs (that comes factory programmed).

- These can be used as it or can be used as a starting point for user custom programs.
- You can reset these to default again by going to “Settings Menu” and running the “Factory Reset” command.

Default Program1:

```
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 endlessl, can be used for testing outputs.

Default Program2:

```
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.

Default Program3:

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

Above program:

- *Sets Motor Speed and Aceeleration*
- *Turn ON output 1*
- *Move motor by 1mm 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…

Default Program5:

```
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. Eq 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.

Default Program6:

```
Speed       S
Accel       1024
        BlokRun     IN3
        Dir CW
        Movmm       D
        Waitfor     MOTOR
        BlokEnd

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

*This is a practical program that can be used for **Linear Movement 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*
- *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 distance (mm) 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 distance (mm) 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 moves the motor in clockwise or counter clockwise direction respectively. Eq if "D" is set to 10, on each input IN3 motor will move 10mms clockwise. Or in each input on IN4 motor will move 10mm in reverse direction.