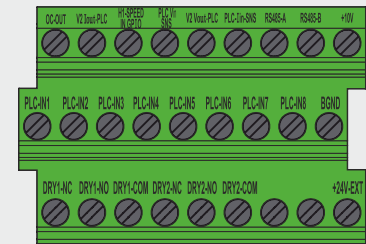
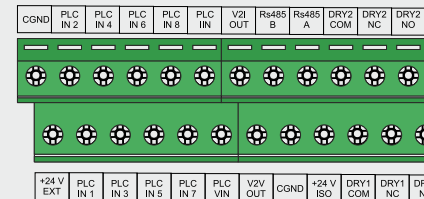
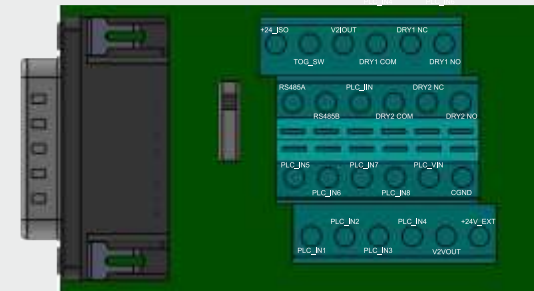




## SHAKTI CONTROL INPUT APPLICATION NOTE



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08 July 2024/ R6

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\* This documents is applicable for the firmware version VFDSMH2C\_1.06 & above for SIMHA platform and VFDNDC\_1.06 & above for NANDI platform

## CHAPTER 2 PLC CONFIGURATION

For SIMHA\_GPD, LOTUS Drive & NANDI Drive fig. 5 shows the display menu for the PLC configuration.

```

graph LR
    PLC_CONFIGURATION[PLC CONFIGURATION] --> PLC_ENABLE[PLC ENABLE]
    PLC_CONFIGURATION --> CONNECTION_TYPE[CONNECTION TYPE]
    PLC_CONFIGURATION --> MOTOR_CONTROL_MODE[MOTOR CONTROL MODE]
    PLC_CONFIGURATION --> ACC_DECE_CONFIG[ACC/DECE CONFIG]
    PLC_CONFIGURATION --> CONST_FREQ_CONFIG[Const Freq config]
    PLC_CONFIGURATION --> RELAY_CONFIG[Relay Config]

    CONNECTION_TYPE --> MODES["3-Wire Mode 1  
3-Wire Mode 2  
2-Wire Mode 1  
2-Wire Mode 2  
RS485 Mode"]

    MOTOR_CONTROL_MODE --> VS_CONTROL[VS CONTROL]
    MOTOR_CONTROL_MODE --> AI_CONTROL[AI CONTROL]
    MOTOR_CONTROL_MODE --> DISPLAY_FREQ_CONF["Display Freq Conf  
RS484 RPM CONTROL  
RS485 FREQ CONTROL"]

    VS_CONTROL --> VS_PARAMS["Vs Min Value  
Vs Min Percentage  
Vs Max Value  
Vs Max Percentage  
Sense Delay Set"]

    AI_CONTROL --> AI_PARAMS["Ai Min Value  
Ai Min Percentage  
Ai Max Value  
Ai Max Percentage  
Sense Delay Set"]

    ACC_DECE_CONFIG --> ACC_CONFIG[ACC Config]
    ACC_DECE_CONFIG --> DECE_CONFIG[Dece Config]

    ACC_CONFIG --> ACC_PARAMS["ACC Config1  
ACC config 2"]

    DECE_CONFIG --> DECE_PARAMS["Dece Config1  
Dece config 2"]

    CONST_FREQ_CONFIG --> FREQ_REF1[FREQ REF1]
    CONST_FREQ_CONFIG --> FREQ_REF2[FREQ REF2]
    CONST_FREQ_CONFIG --> FREQ_REF3[FREQ REF3]

    RELAY_CONFIG --> RELAY_ONE_CONFIG[RELAY ONE CONFIG]
    RELAY_CONFIG --> RELAY_TWO_CONFIG[RELAY TWO CONFIG]

    RELAY_ONE_CONFIG --> RELAY_ONE_ENABLE[RELAY ONE ENABLE]
    RELAY_ONE_CONFIG --> RELAY_ONE_FUNCTION[RELAY ONE FUNCTION]
    RELAY_ONE_FUNCTION --> FAULT[FAULT]

    RELAY_TWO_CONFIG --> RELAY_TWO_ENABLE[RELAY TWO ENABLE]
    RELAY_TWO_CONFIG --> RELAY_TWO_FUNCTION[RELAY TWO FUNCTION]
    RELAY_TWO_FUNCTION --> RELAY_TWO_PARAMS["FREQUENCY DETECT  
STOP-SIGNAL FRQ  
UV SIGNAL  
OL EARLY WARNING  
RUN INDICATE  
Fmax Reached  
Speed1 reached  
Speed2 reached  
Speed3 reached"]
  
```



CGND	PLC B3.2	PLC B3.4	PLC B3.6	PLC B3.8	PLC B3N	V21 OUT	R48B5 B	R48B5 A	DRY2 COM	DRY2 NC	DRY2 NO
+24 V EXT	PLC B1.1	PLC B1.3	PLC B1.5	PLC B1.7	PLC B1.9	V2V OUT	CGND	+24 V ISO	DRY1 COM	DRY1 NC	DRY1 NO

Diagram of a 16-bit parallel bus architecture. The top row shows 16 pins: DC-OUT, VL12V-PUL, P-REF, P-INT, VL12V-PUL, P-CH-20MS, P-CH-4, P-CH-8, P-CH-16, P-CH-32, P-CH-64, P-CH-128, P-CH-256, P-CH-512, P-CH-1024, and +VCC. The bottom row shows 16 pins: P-CH-1, P-CH-2, P-CH-3, P-CH-4, P-CH-5, P-CH-6, P-CH-7, P-CH-8, P-CH-9, P-CH-10, P-CH-11, P-CH-12, P-CH-13, P-CH-14, P-CH-15, and P-CH-16. The bus is labeled 'DRY-16' and 'DRY-16'.

**Fig.4 Lotus Terminal Block**



### SLIDER SWITCH CONFIGURATION

The Slider Switch should be at CGND. For SIMHA 2.0 GPD, Slider Switch should be at the rightmost position considering the PLC card is held with its connector on the top. For NANDI DRIVE, Slider Switch should be at bottom considering the internal fan is above the control card. Whereas for NANDI MICRO, the Slider switch should be at top. For LOTUS DRIVE, Slider Switch should be near to the PLC terminal block. For all above slider switch connections, connect internal common point to GND.

### PINS DESCRIPTION

This section contains pins description

#### CONNECTOR - J1

+24V ISO	: Voltage supply +24V ISO
RS485_A	: RS485 A
RS485_B	: RS485 B
V2 Iout PLC	: Current Output
PLC Iin SNS	: Current Input Sense

#### CONNECTOR - J2

1. PLC IN1	: ESTOP
PLC IN5	: ACC/DACC
PLC IN2	: Di1
PLC IN6	: X1
PLC IN3	: Di2
PLC IN7	: X2

#### CONNECTOR - J3

DRY1 COM	: Dry Contact Common
DRY2 COM	: Dry Contact Common
DRY1 NC	: Dry Contact NC
DRY2 NC	: Dry Contact NC
DRY1 NO	: Dry Contact NO
DRY2 NO	: Dry Contact NO

#### CONNECTOR - J4

PLC IN4	: Di3
PLC IN8	: RST
V2 Vout PLC	: Voltage Output
PLC Vin SNS	: Voltage Input Sense
+24V EXT	: External Voltage supply +24V
CGND	: Common Ground

**Note:**  
Pin name is mentioned at the back side of the plc card

### PINS CONFIGURATION

**RS485-A and RS485-B:** For RS485 communication to configure device parameters i.e, frequency and speed

**DRY1 NC, DRY1 NO and DRY1 COM:** For fault detection, in normal operation DRY1COM pin is connected to DRY1NC and in case of any fault in the drive, DRY1COM pin will connect to DRY1NO as shown in fig.6



Fig.6 Relay 1 normal and fault operation

**DRY2 NC, DRY2 NO and DRY2 COM** is a programmable relay which has multiple functions which can be configured from the display, Eg: While performing Freq-Detect operation, Select Freq-Detect on display first through MENU >> PLC CONFIGURATION >> RELAY CONFIG >> RELAY TWO CONFIG >> RELAY TWO FUNCTION>> FREQ DETECT, then set the frequency accordingly. if the below conditions meet than DRY2COM pin will connect to DRY2NO as shown in fig.7

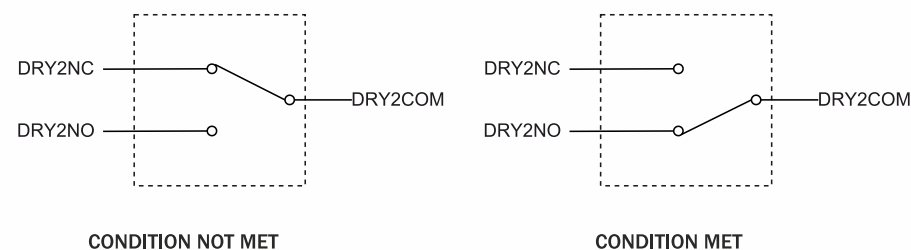


Fig.7 Relay 2 normal and fault operation

**Freq-Detect : Output Frequency > Freq\_detection\_Val**

The condition will meet when output frequency is more than “Freq-Detect Val” and it will reset when output frequency is less than “0.95\* Freq-Detect Val” as shown in fig.8

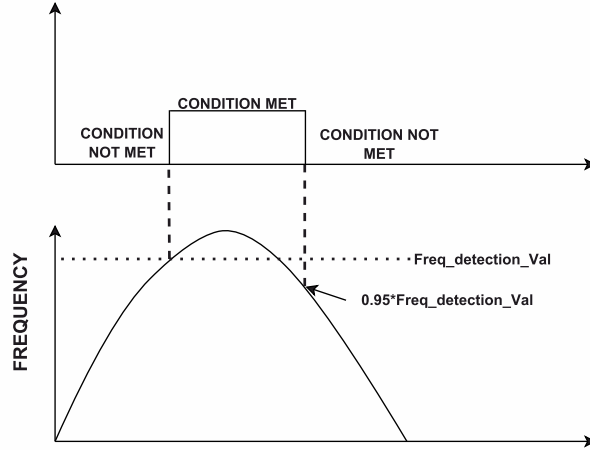


Fig.8 Freq- detect function

**Stop\_Sig\_Freq: Output Frequency < Stop\_Sig\_Freq Val(Hz)**

The condition will meet when output frequency is less than “Stop\_Sig\_Freq\_Val” in case when motor is turning off as shown in fig.9

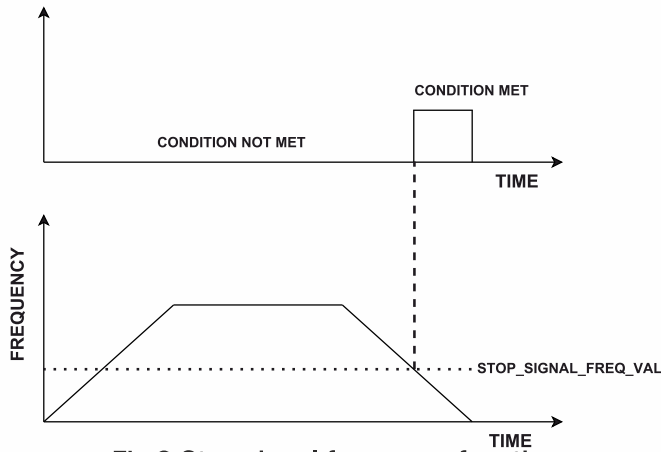


Fig.9 Stop-signal-frequency function

**UV Signal : DC Bus Vtg < UV setting Val**

The condition will meet when DC Bus Voltage is less than “UV setting val” as shown in fig.10

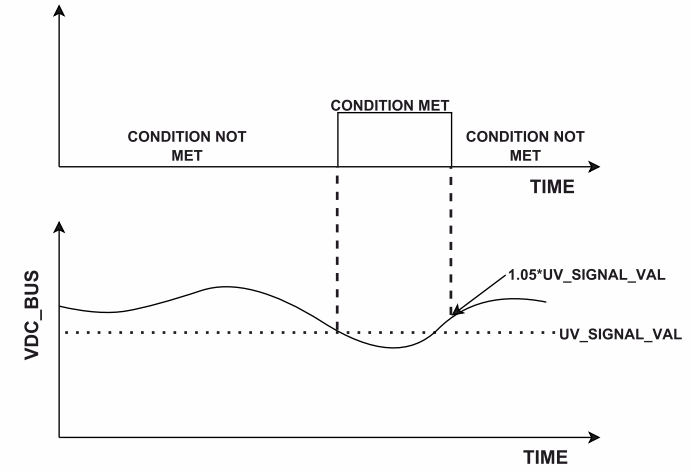


Fig.10 UV Signal function

**OL-Early\_Warn : Output current > Over current limit\*OL Early warn val %**

The condition will meet when inverter output current is more than the %value of the over current limit in “OL-Early warning” as shown in fig.11

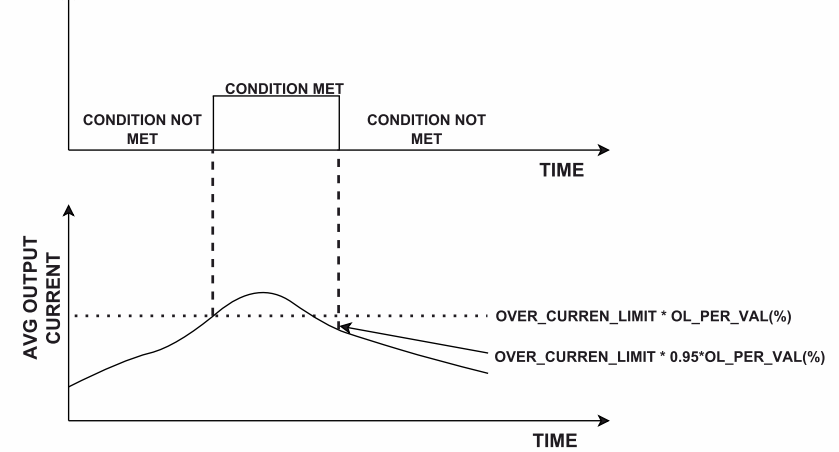


Fig.11 OL-Early Warn function

**Run Indicate:** Running status

The condition will met when the output is in ON condition

**Fmax Reached:** (Output frequency > 0.98\*Max Freq) OR (Speed\_Ref > 6.15\*MAX Freq)

The condition will meet when output frequency reaches more than 0.98 times the set “MAX Freq” or speed reaches more than 6.15 times of the the set “MAX Freq” as shown in fig.12

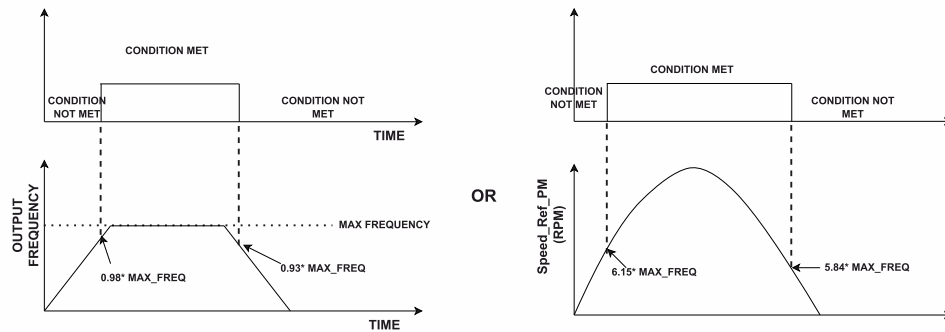


Fig.12 Fmax function

**Speed1 Reach :** Output frequency > Freq1

The condition will meet when output frequency becomes more than 0.98 times of “FREQ1” which is selected through X1 and X2 as shown in fig.13

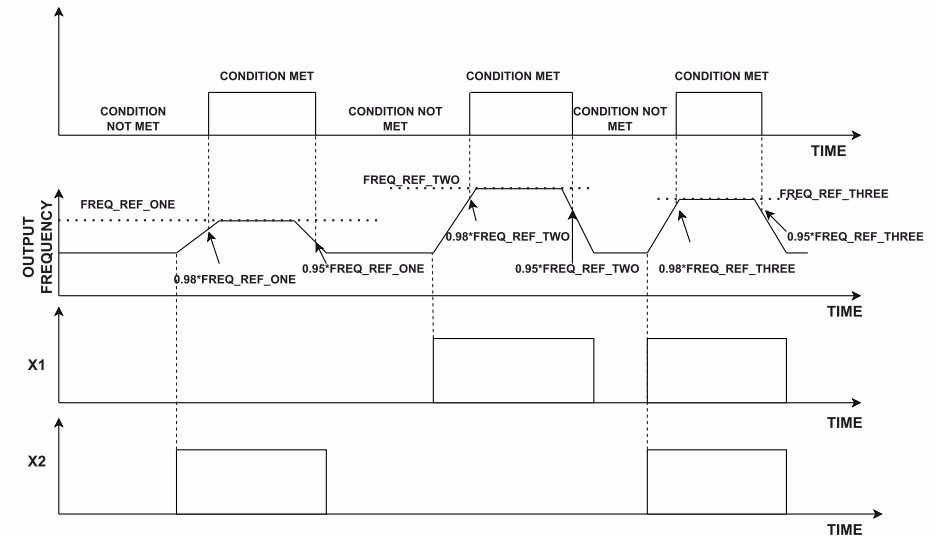


Fig.13 Speed Reach function

**Speed 2 Reach :** Output frequency > Freq2

The condition will meet when output frequency becomes more than 0.98 times of “FREQ2” which is selected through X1 and X2 as shown in fig.13

**Speed 3 Reach :** Output frequency > Freq3

The condition will meet when output frequency becomes more than 0.98 times of “FREQ3” which is selected through X1 and X2 as shown in fig.13

### DIGITAL INPUT CONFIGURATION :

8 digital inputs i.e., PLC IN1 to PLC IN8 is used for controlling the motor in various modes controlled by MACROS selection. Basic MACROS are given below:

- 2 wire Mode 1 operation
- 2 wire Mode 2 operation
- 3 wire Mode 1 operation
- 3 wire Mode 2 operation

NOTE: In this document, 0 and 1 represents the following:  
0: Not connected (NOT ACTIVATED),

1: Connected to +24V wrt CGND (ACTIVATED)

PLC IN5: ACC/DECE: For these mode of operations acceleration and deceleration is defined as follows:

ACC/DACC	ACCELERATION/DECELERATION
0	ACCELERATION_RATE/ DECELERATION_RATE
1	ACCELERATION1_RATE/ DECELERATION1_RATE

PLCIN6, PLCIN7: X1 and X2 are the two inputs, which decides the speed reference of the motor in both modes of operation while running in either of the operation i.e, 2 wire operation and 3 wire operation

X1	X2	SPEED REF
0	0	VS, AI, DIS, RS485_FREQ, RS485_RPM
0	1	FREQ_REF_ONE
1	0	FREQ_REF_TWO
1	1	FREQ_REF_THREE

### 2-Wire Mode 1 operation

In this mode, when the digital input of Di1 or Di3 is pull high continuously the motor will run. Below table shows the motor rotation direction corresponding to the terminal input combination

**Float Switch :** Through 2-Wire Mode 1, float switch can be used to turn ON/OFF the motor. The float switch should be connected between Di1 & 24V.

Di1 - Activate for forward direction

Di3 - Activate for reverse direction

Di1	Di3	MOTOR DIRECTION
0	0	STOP
0	1	REVERSE
1	0	FORWARD
1	1	STOP

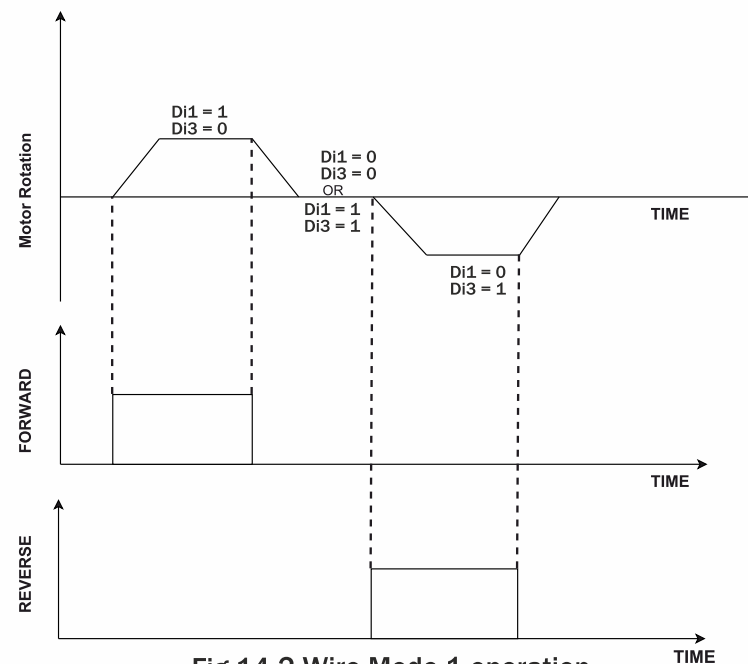


Fig.14 2-Wire Mode 1 operation

**Float Switch Connection for Long Wire**

While operating the float switch with long wire the recommended circuit is shown in the fig.15 below. A three wire float switch is required for long wire operation. At first enable the PLC mode and select "2-Wire Mode 1" in "Connection Type". After that, set the desired RPM to the full value under the "Display Freq Config" option in the Motor Control section. Make sure that the slider switch is in the bottom i.e. towards the power terminal block during this operation.

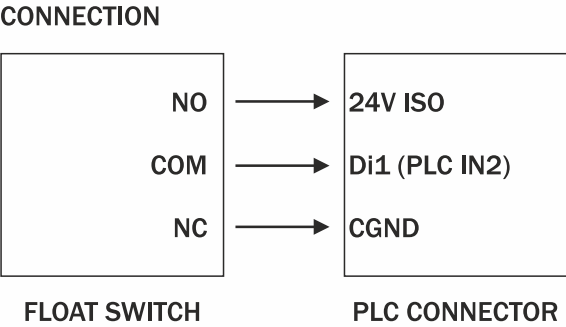


Fig.15

Connection of Float Switch for Long Wire Operation

Note: Polarity of NO and NC can be changed as per requirement.

**2-Wire Mode 2 operation**

In this mode, the motor will run only if the Di1 terminal is pull high continuously and to activate the reverse rotation Di3 needs to be pull high. Below table shows the motor rotation direction corresponding to the terminal input combination.

Di1 - Activate to start motor  
Di3 - Activate for reverse direction

Di1	Di3	MOTOR DIRECTION
0	0	STOP
0	1	STOP
1	0	FORWARD
1	1	REVERSE

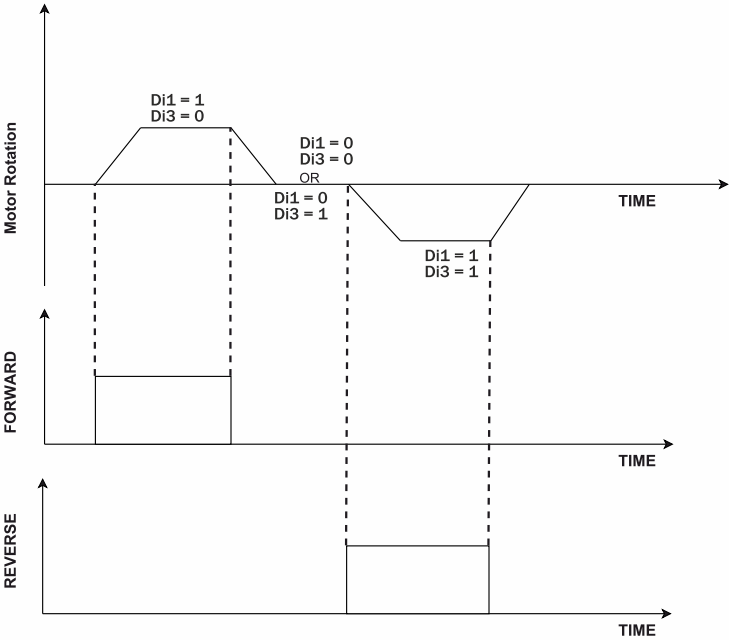


Fig.16 2-Wire Mode 2 operation



**3-wire Mode 1 operation**

In this operation, 3 terminals Di1, Di2 and Di3 are used. Following are the motor operation for the respective terminals:

Di1 - Momentary Activate for forward direction.

Di2 - Open to stop the motor

Di3 - Activate for reverse direction

X - Don't care

Di1	Di2	Di3	Motor Direction
X	0	X	Stop
1 (5ms Pulse Width)	1	0	Forward
1 (5ms Pulse Width)	1	1	Reverse

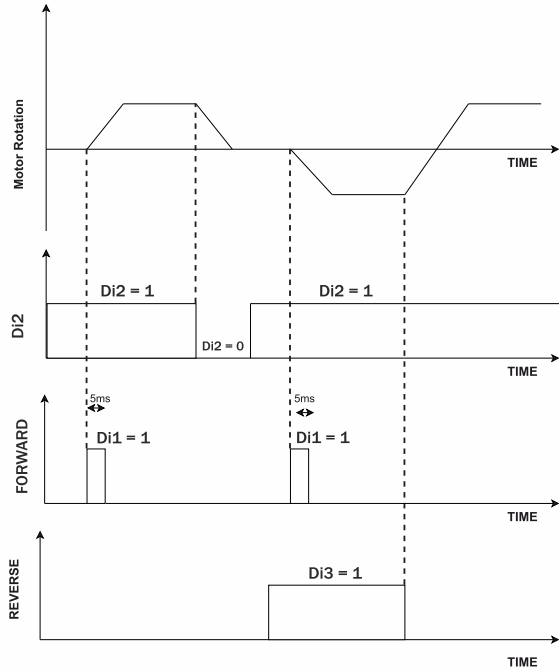


Fig.17 3-Wire Mode 1 operation

**3-wire Mode 2 operation:**

In this operation, 3 terminals Di1, Di2 and Di3 are used. Following are the motor operation for the respective terminals:

Di1 - Momentary Activate for forward direction

Di2 - Open to stop the motor

Di3 - Momentary Activate for reverse direction

X - Don't care

Di1	Di2	Di3	Motor Direction
X	0	X	Stop
1 (5ms Pulse Width)	1	0	Forward
0	1	1 (5ms Pulse Width)	Reverse

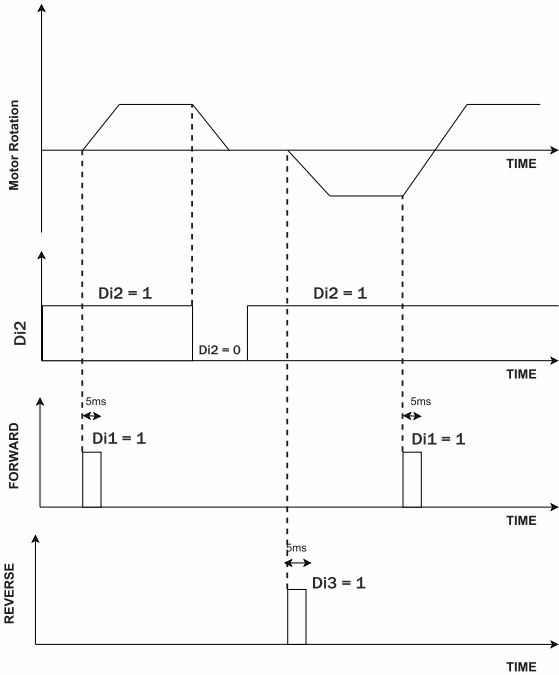


Fig.18 3-Wire Mode 2 operation

**Analog Input Configuration :** Two analog inputs i.e., PLC Vin SNS to PLC Iin SNS is used for controlling the motor speed when X1(PLCIN6) and X2 (PLCIN7) is set to 0 as mentioned in the digital input configuration section.

**PLC Vin SNS :** Voltage input from potentiometer for the motor RPM reference. (Range from 0-10 V)  
\*Recommendation\*: use 10k potentiometer.

**PLC Iin SNS :** Current input for the motor RPM reference. (Range from 4-20 mA)

CHAPTER 3 AUX CONFIGURATION

In SIMHA solar drive, there is a 5 pins connector as shown in fig. 2.Fig.18 shows the AUX CONFIGURATION menu

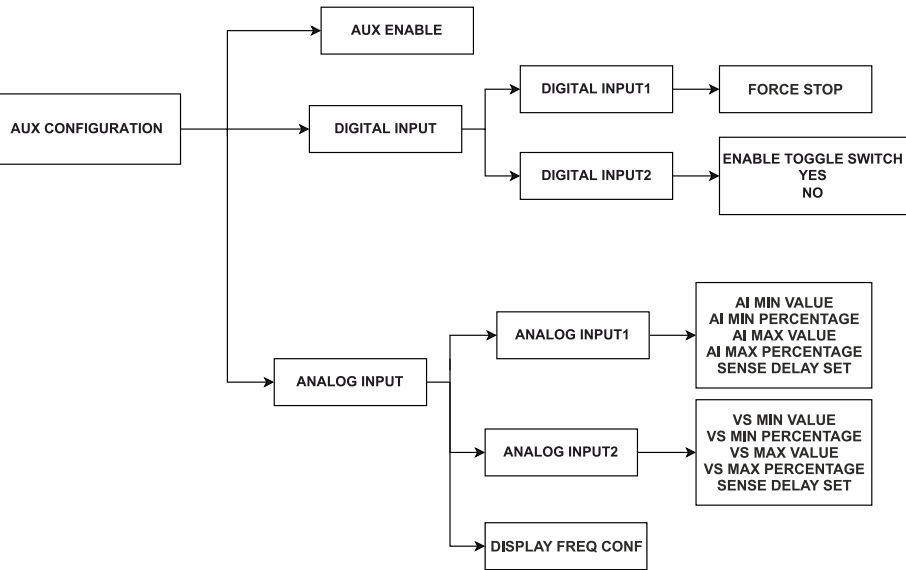


Fig.19 Aux Configuration Menu Tree

Following are the PIN description and their configuration

3.1 PIN DESCRIPTION:

- D1: Digital Input 1
- D2: Digital Input 2
- GND
- A1: Analog Input 1
- A2: Analog Input 2

3.2 PIN CONFIGURATION

By default speed reference of the motor is set to DISPLAY FREQ CONFIG in ANALOG INPUT.

- 3.2.1 D1-For force stopping: In motor running condition if this PIN is connected to CGND pin the motor will be turned off
- 3.2.2 D2:-Toggle Switch: To enable this functionality; first enable the toggle switch from the display.  
If enable, to turn ON the motor connect D2 to the CGND pin. Speed reference of the motor is decided by the analog inputs.
- 3.2.3 A1- Current input for the Speed reference of motor wrt CGND pin.
- 3.2.4 A2- Voltage input for the Speed reference of motor wrt CGND pin.

3.3 FLOAT SWITCH

Float switch can be used to turn ON/OFF the motor through D2. To enable this functionality, first enable the toggle switch in Digital Input 2 from the display. The float switch should be connected between D2 and GND.