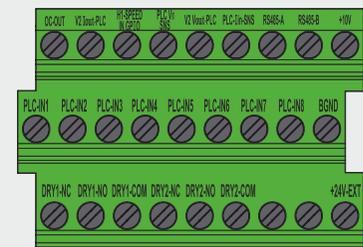
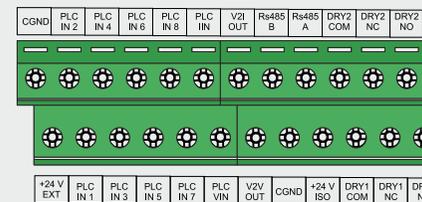
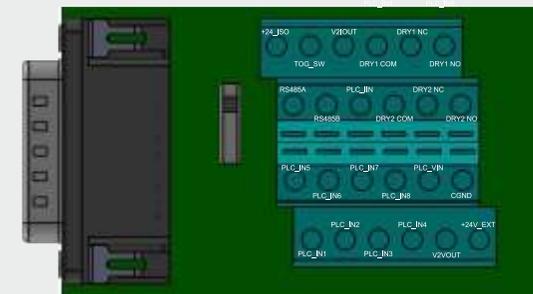




SHAKTI CONTROL INPUT APPLICATION NOTE



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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 1: INTRODUCTION

This document describes the usage of control inputs for all (SIMHA and NANDI series) SHAKTI PUMPS drives. There are 8 digital inputs, 2 analog inputs and 2 analog outputs available in the terminal connection block. Moreover, a non-regulated power supply of 20-24V, 100mA is also available on the terminal block. The SHAKTI drives uses a MACRO based configuration for control purpose. The purpose of this document is to provide with the information necessary to select, modify and apply application macros to the operation of SHAKTI drive. The control input functionality and MACRO description presented in this document. For accessing the control input functionality in SIMHA_GPD, LOTUS Drive & NANDI Drive go to MENU>>CONFIGURE>>PLC CONFIGURATION. And for SIMHA_SOLAR drive go to MENU>>CONFIGURE>>AUX CONFIGURATION. Terminal Connection Block of SIMHA 2.0 GPD, SIMHA 2.0 Solar, NANDI & LOTUS Drive is shown in fig.1,fig.2 , fig. 3 & fig.4 respectively.

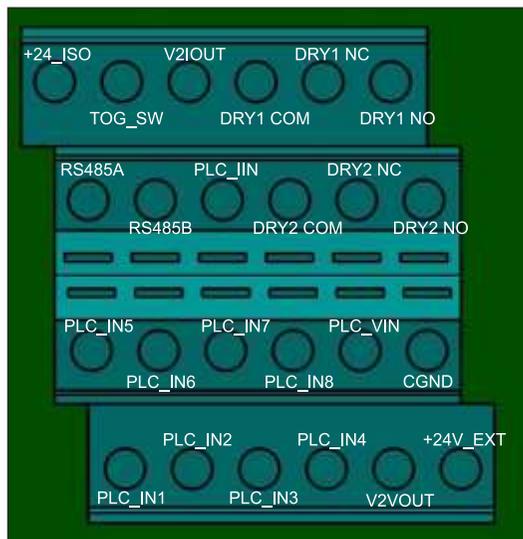


Fig. 1 SIMHA_GPD Terminal Block



Fig. 2 SIMHA_Solar Terminal Block

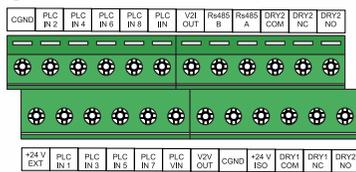


Fig.3 NANDI Terminal Block

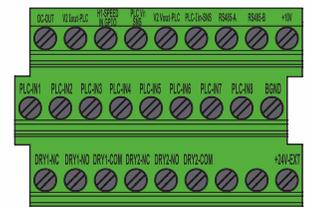


Fig.4 Lotus Terminal Block



CHAPTER 2 PLC CONFIGURATION

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

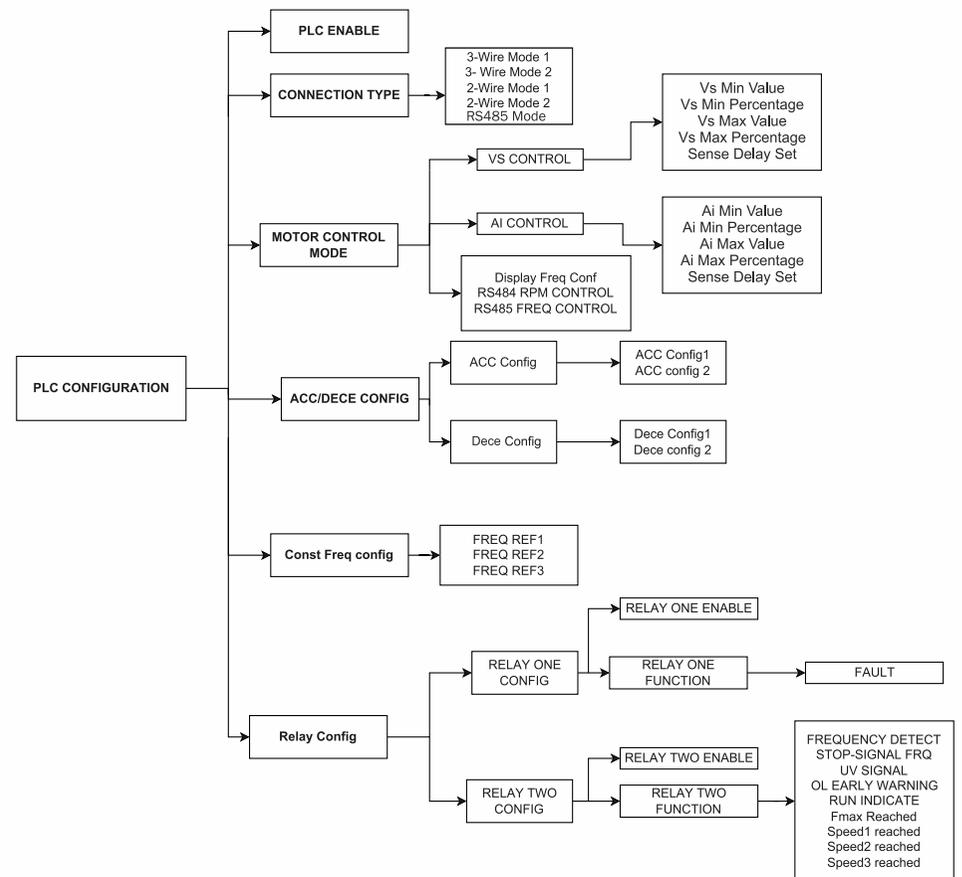


Fig.5 FLC configuration menu tree

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

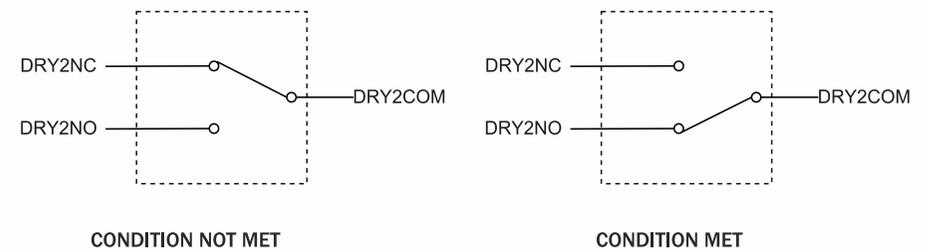


Fig.7 Relay 2 normal and fault operation

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

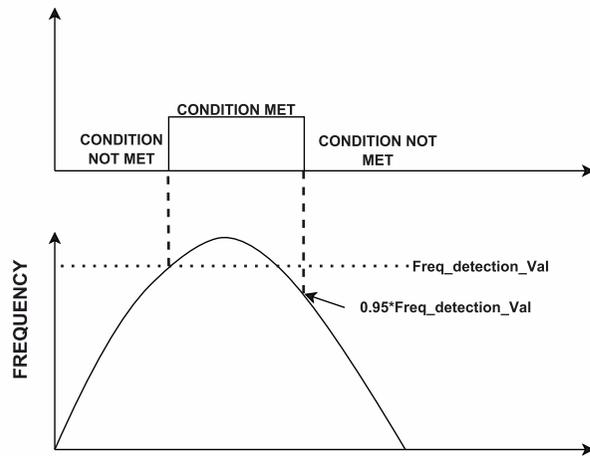


Fig.8 Freq- detect function

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

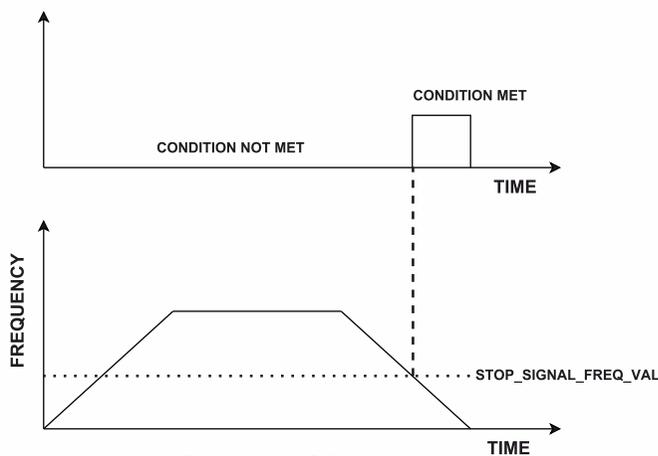


Fig.9 Stop-signal-frequency function

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

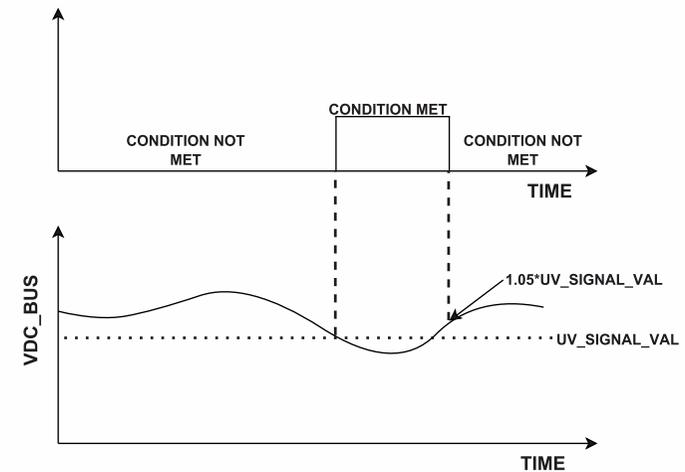


Fig.10 UV Signal function

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

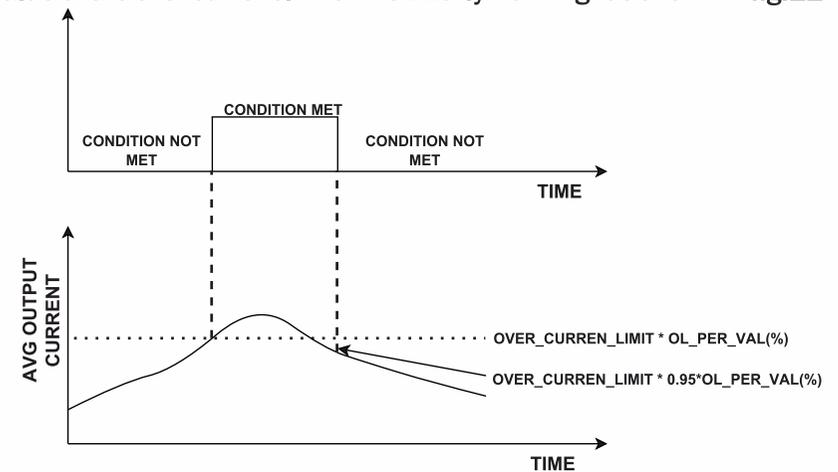


Fig.11 OL-Early Warn function

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

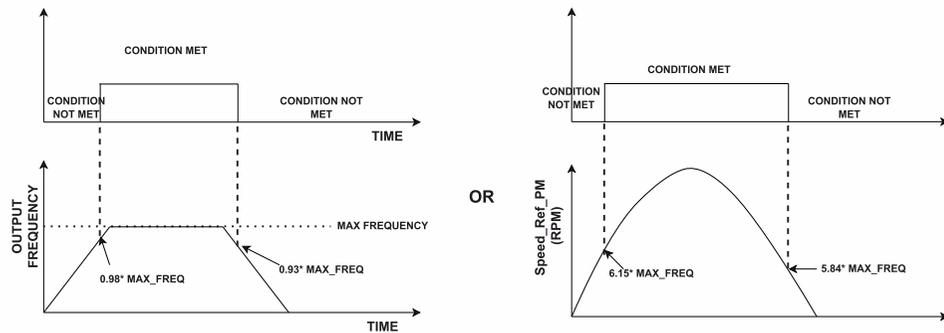


Fig.12 Fmax function

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

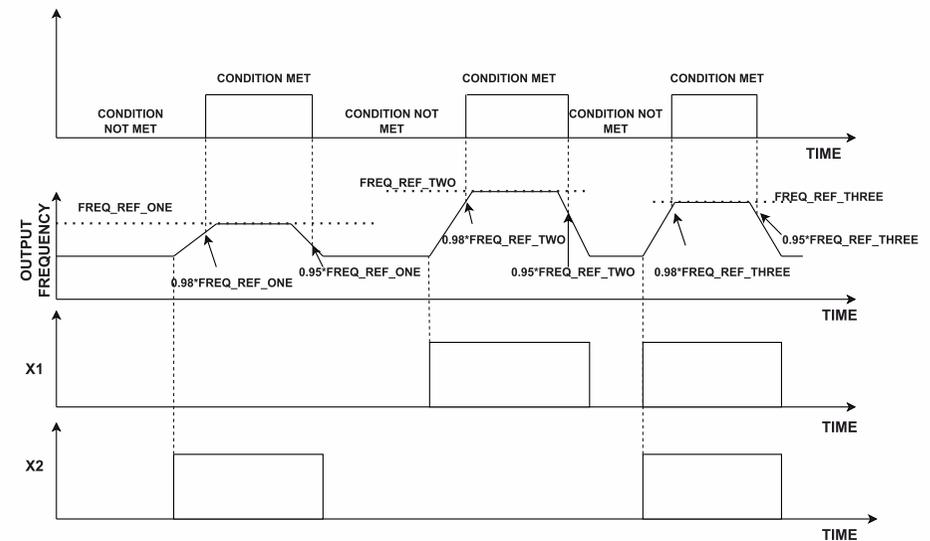


Fig.13 Speed Reach function

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/ DECCELERATION1_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

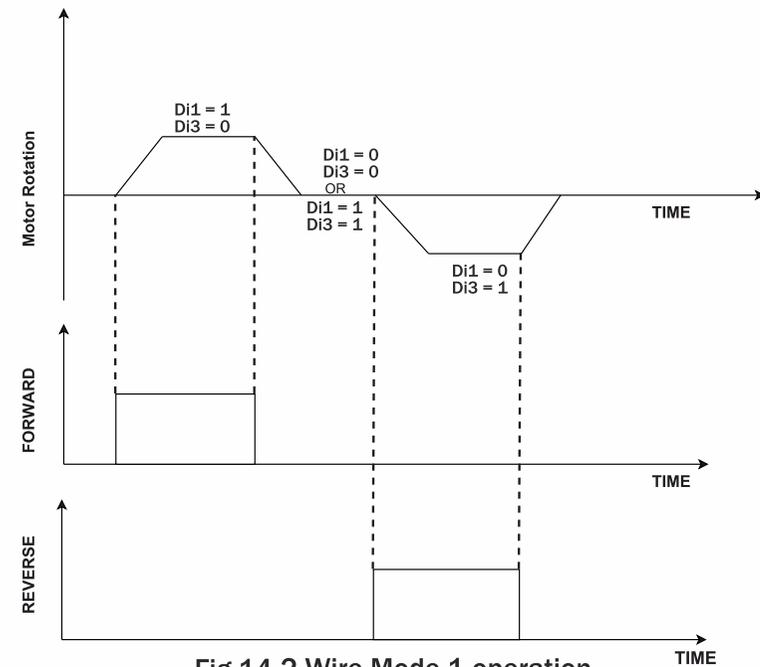


Fig.14 2-Wire Mode 1 operation

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.

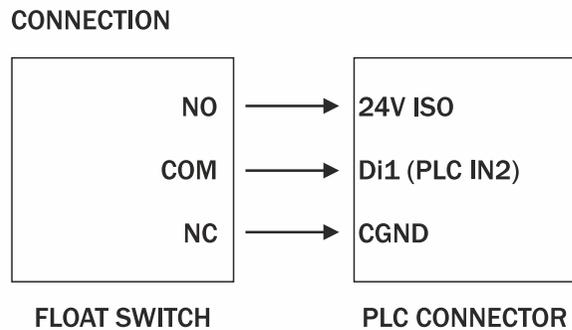


Fig.15

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

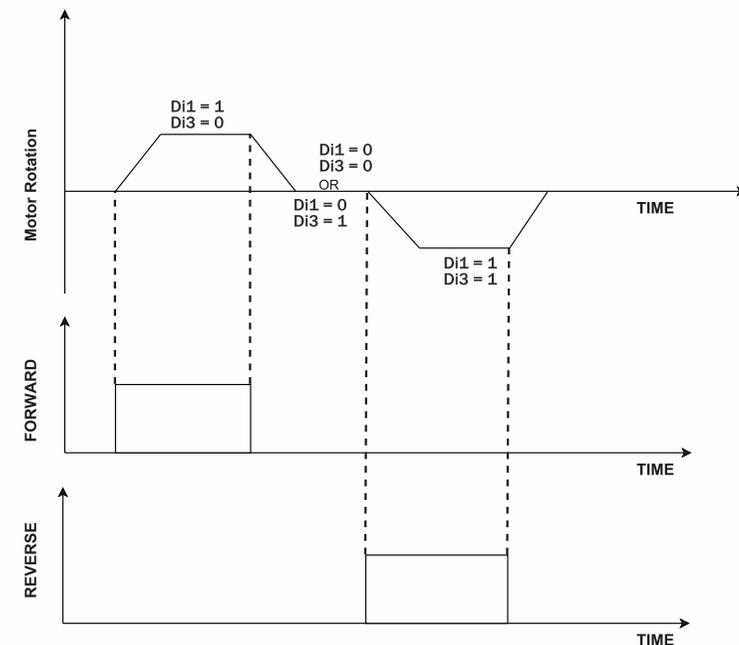


Fig.16 2-Wire Mode 2 operation

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

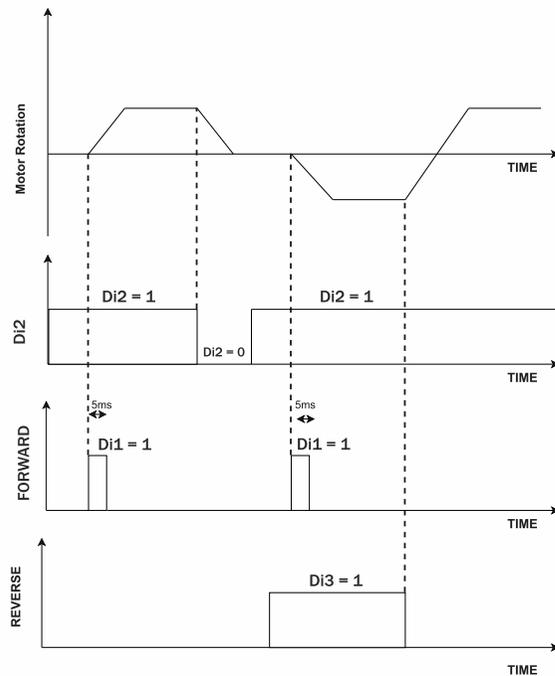


Fig.17 3-Wire Mode 1 operation

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

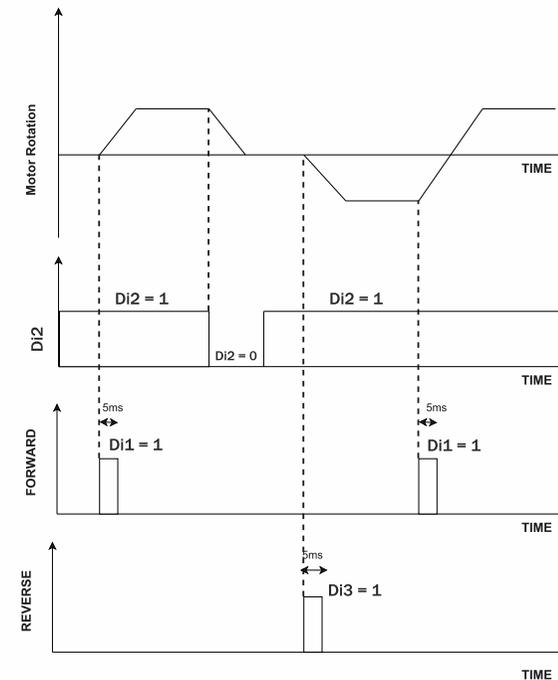


Fig.18 3-Wire Mode 2 operation

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

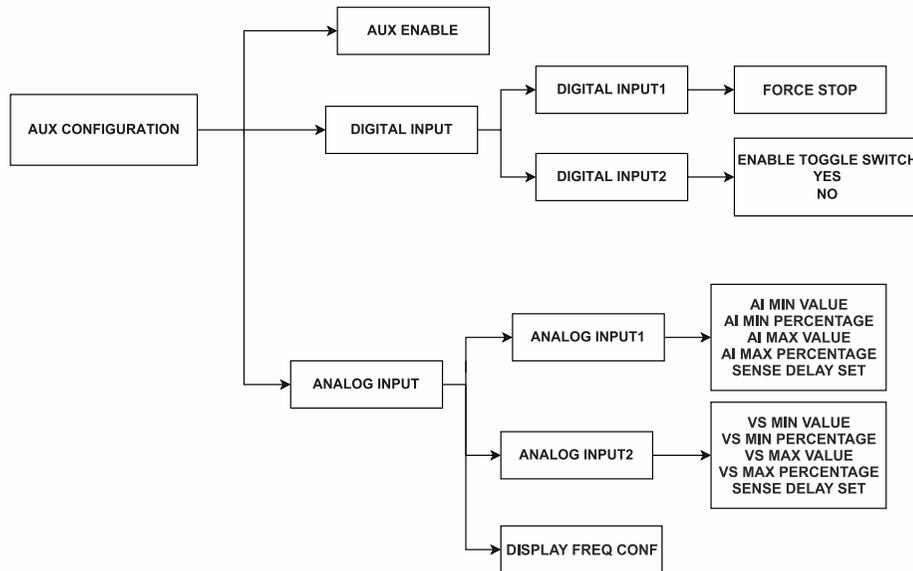


Fig.19 Aux Configuration Menu Tree

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.