Optidrive Applications Support Library

Application Note	AN-ODV-2-021
Title	Setting Up Preset Speeds
Related Products	Optidrive HVAC
Level **1**	1 – Fundamental - No previous experience necessary 2 – Basic – Some Basic drives knowledge recommended 3 – Advanced – Some Basic drives knowledge required 4 – Expert – Good experience in topic of subject matter recommended

Overview

The Optidrive HVAC can be configured to operate with up to a maximum 8 preset speeds. This application shows some of the common configurations for preset speeds. The preset speed parameters allow for both the setting of positive and negative values, allowing for each preset to be individually configured for a forward or reverse direction. Alternatively the forward / reverse selection can be made independently of the preset speed selection giving mirrored preset speeds in the opposite direction.

There are two methods for enabling preset speeds on the Optidrive HVAC and configuring the digital input selection.

1. Select one of the preset speed configurations using the Digital Input Configuration Parameter (P1-13)
2. Set P1-13 to 0 and assign preset digital input functionality using menu 9 (Advanced drive logic control)

Preset speed selection might be performed using logic selector switches or by a controlling PLC. For simplicity this application note shows examples using selector switches to clearly show logic conditions on the digital inputs to the drive.

Selecting Preset speeds using the Digital Input selection parameter P1-13.

For alternative preset speed configurations parameter menu 9 editing is required as defined later in this application note.

The Digital Input Selection Parameter P1-13 allows predefined digital input configurations to chosen from a table provided in the user manual. The Optidrive HVAC has several settings for parameter P1-13 that configure some drive preset speed functionality. The predefined preset speed selections in parameter P1-13 allow for selection of one or two preset speed configurations. For more preset speeds (up to eight) or for different preset speed configurations parameter menu 9 editing is required as defined later in this application note.

⚠️	Note: Connection diagrams shown below for the different settings of P1-13 bypass the Safe Torque Off Input function on terminals 12 and 13. If Safe Torque Off functionality is required then these terminals must be connected to meet the requirements of the legislation governing such installations.

Preset speed 1 value (commanded speed when preset speed 1 is selected) is set in parameter P2-01

Preset speed 2 value (commanded speed when preset speed 2 is selected) is set in parameter P2-02

Preset speed 3 value (commanded speed when preset speed 3 is selected) is set in parameter P2-03

Preset speed 4 value (commanded speed when preset speed 4 is selected) is set in parameter P2-04

Preset speed 5 value (commanded speed when preset speed 5 is selected) is set in parameter P2-05

Preset speed 6 value (commanded speed when preset speed 6 is selected) is set in parameter P2-06

Preset speed 7 value (commanded speed when preset speed 7 is selected) is set in parameter P2-07

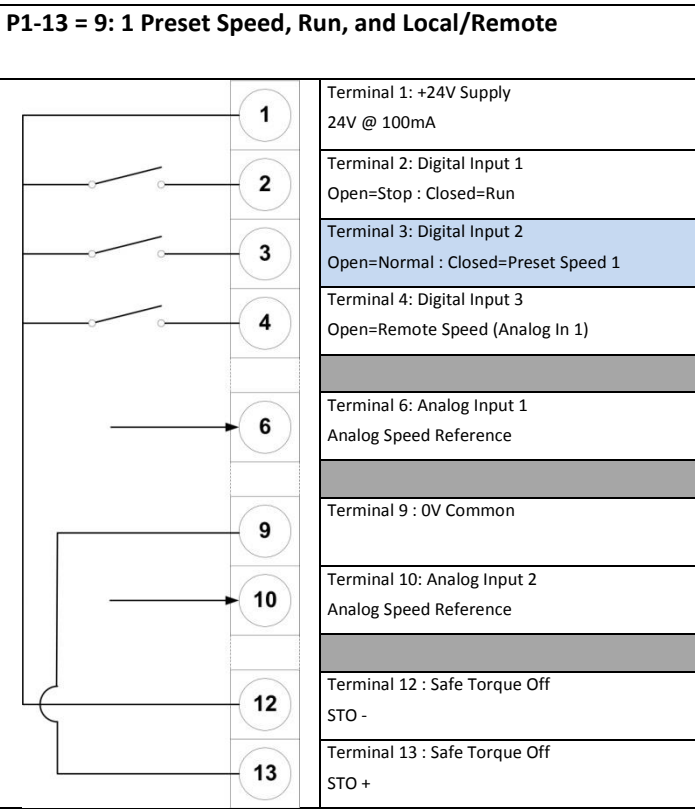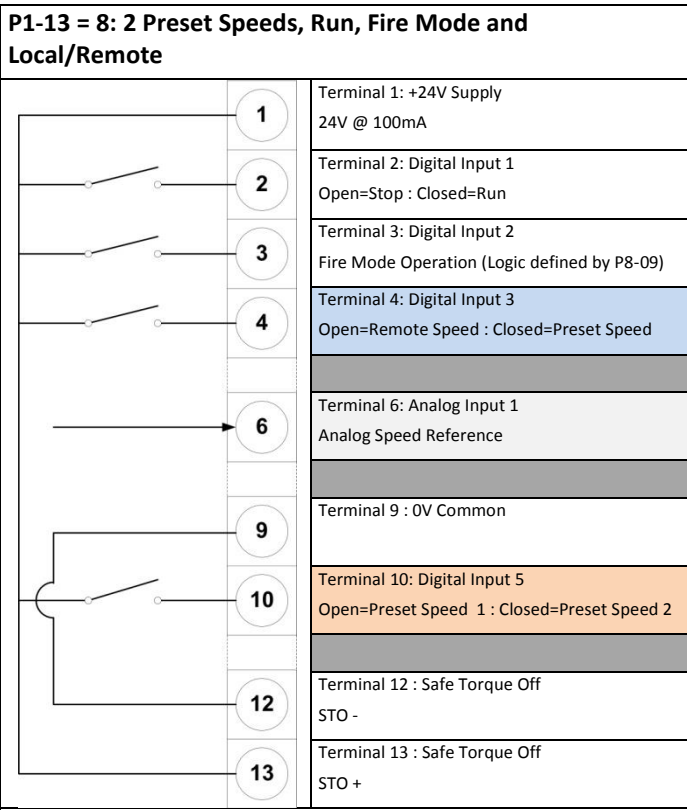Preset speed 8 value (commanded speed when preset speed 8 is selected) is set in parameter P2-08

If order to access menu 2 a level 1 security code is required to be set in parameter P1-14 (default value 101).
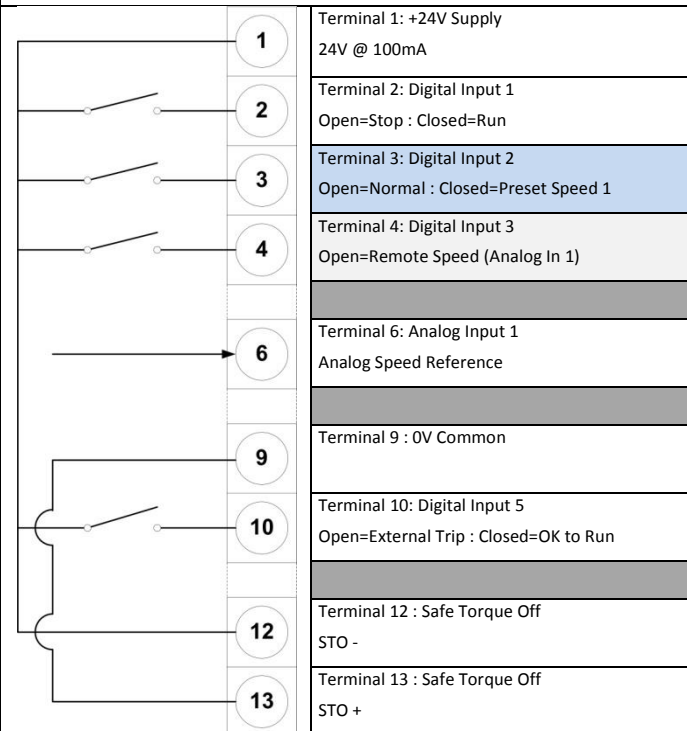
Note: Preset speeds 5 to 8 (P2-05 to P2-08) are automatically assigned to some of the drive dedicated HVAC functionality when those functions are enabled. Care should be taken to ensure the preset speed functionality both not conflict with these HVAC functions if they are required / enabled in the application.

Connection diagrams for the configurations provided by parameter P1-13 are shown below:

P1-13 = 1: 1 Preset Speed, Run and Local/Remote

Terminal	Description
1	Terminal 1: +24V Supply — 24V @ 100mA
2	Terminal 2: Digital Input 1 — Open=Stop : Closed=Run
3	Terminal 3: Digital Input 2 — Open=Normal : Closed=Preset Speed 1
4	Terminal 4: Digital Input 3 — Open=Remote Speed (Analog In 1)
6	Terminal 6: Analog Input 1 — Analog Speed Reference
9	Terminal 9: 0V Common
10	Terminal 10: Analog Input 2 — Analog Speed Reference
12	Terminal 12 : Safe Torque Off — STO -
13	Terminal 13 : Safe Torque Off — STO +

P1-13 = 5: 2 Preset Speeds, Run, Local/Remote and External Trip

Terminal	Description
1	Terminal 1: +24V Supply — 24V @ 100mA
2	Terminal 2: Digital Input 1 — Open=Stop : Closed=Run
3	Terminal 3: Digital Input 2 — Open=Preset Speed 1 : Closed=Preset Speed 2
4	Terminal 4: Digital Input 3 — Open=Remote Speed : Closed=Preset Speed
6	Terminal 6: Analog Input 1 — Analog Speed Reference
9	Terminal 9: 0V Common
10	Terminal 10: Digital Input 5 — Open=External Trip : Closed=OK to Run
12	Terminal 12 : Safe Torque Off — STO -
13	Terminal 13 : Safe Torque Off — STO +

P1-13 = 6: 2 Preset Speeds, Momentary Start/Stop and Local/Remote

Terminal	Description
1	Terminal 1: +24V Supply — 24V @ 100mA
2	Terminal 2: Digital Input 1 — Open=No Function : Momentary Closed=Start
3	Terminal 3: Digital Input 2 — Momentary Open=Stop : Closed=Enable
4	Terminal 4: Digital Input 3 — Open=Remote Speed : Closed=Preset Speed
6	Terminal 6: Analog Input 1 — Analog Speed Reference
9	Terminal 9 : 0V Common
10	Terminal 10: Digital Input 5 — Open=Preset Speed 1 : Closed=Preset Speed 2
12	Terminal 12 : Safe Torque Off — STO -
13	Terminal 13 : Safe Torque Off — STO +

P1-13 = 7: 2 Preset Speeds, Run, Fwd/Rev and Local/Remote

Terminal	Description
1	Terminal 1: +24V Supply — 24V @ 100mA
2	Terminal 2: Digital Input 1 — Open=Stop : Closed=Run
3	Terminal 3: Digital Input 2 — Open=Forward : Closed=Reverse
4	Terminal 4: Digital Input 3 — Open=Remote Speed : Closed=Preset Speed
6	Terminal 6: Analog Input 1 — Analog Speed Reference
9	Terminal 9 : 0V Common
10	Terminal 10: Digital Input 5 — Open=Preset Speed 1 : Closed=Preset Speed 2
12	Terminal 12 : Safe Torque Off — STO -
13	Terminal 13 : Safe Torque Off — STO +

P1-13 = 8: 2 Preset Speeds, Run, Fire Mode and Local/Remote

Terminal	Description
1	Terminal 1: +24V Supply 24V @ 100mA
2	Terminal 2: Digital Input 1 Open=Stop : Closed=Run
3	Terminal 3: Digital Input 2 Fire Mode Operation (Logic defined by P8-09)
4	Terminal 4: Digital Input 3 Open=Remote Speed : Closed=Preset Speed
6	Terminal 6: Analog Input 1 Analog Speed Reference
9	Terminal 9 : 0V Common
10	Terminal 10: Digital Input 5 Open=Preset Speed 1 : Closed=Preset Speed 2
12	Terminal 12 : Safe Torque Off STO -
13	Terminal 13 : Safe Torque Off STO +

P1-13 = 9: 1 Preset Speed, Run, and Local/Remote

Terminal	Description
1	Terminal 1: +24V Supply 24V @ 100mA
2	Terminal 2: Digital Input 1 Open=Stop : Closed=Run
3	Terminal 3: Digital Input 2 Open=Normal : Closed=Preset Speed 1
4	Terminal 4: Digital Input 3 Open=Remote Speed (Analog In 1)
6	Terminal 6: Analog Input 1 Analog Speed Reference
9	Terminal 9 : 0V Common
10	Terminal 10: Analog Input 2 Analog Speed Reference
12	Terminal 12 : Safe Torque Off STO -
13	Terminal 13 : Safe Torque Off STO +

P1-13 = 10: 1 Preset Speed, Run, Local/Remote and External Trip

Terminal	Description
1	Terminal 1: +24V Supply 24V @ 100mA
2	Terminal 2: Digital Input 1 Open=Stop : Closed=Run
3	Terminal 3: Digital Input 2 Open=Normal : Closed=Preset Speed 1
4	Terminal 4: Digital Input 3 Open=Remote Speed (Analog In 1)
6	Terminal 6: Analog Input 1 Analog Speed Reference
9	Terminal 9 : 0V Common
10	Terminal 10: Digital Input 5 Open=External Trip : Closed=OK to Run
12	Terminal 12 : Safe Torque Off STO -
13	Terminal 13 : Safe Torque Off STO +

▯ : Preset Speed Mode Selection

▯ : Preset Speed Reference Selection

LSB = Least Significant Bit / MSB = Most Significant Bit

Selecting Preset speeds using Parameter Menu 9.

Drive Menu 9 (Advanced drive logic configuration) allows customised configuration of the digital inputs to provide Preset speed functionality.

Parameter P1-13, Digital Input Configuration Parameter, must be set to 0 to allow user configuration of menu 9.

Security access parameter (P1-14) must be set with the level 2 security code (Default 201) for access to menu 9.

Configurations for four and eight preset speeds use a rotary binary switch that converts each position into a binary number. The four preset speed configurations use a two pole binary switch (using two digital inputs) whilst the eight preset speed configurations show a three pole binary switch (using three digital inputs). The true table for selection of the preset speed parameters is shown below.

For 4 & 8 Speed Configurations		For 8 Speed Configurations Only	
Input 1 (LSB)	Input 2	Input 3 (MLSB)	Preset Speed Selected
Open	Open	Open	Preset 1 – P2-01
Closed	Open	Open	Preset 2 – P2-02
Open	Closed	Open	Preset 3 – P2-03
Closed	Closed	Open	Preset 4 – P2-04
Open	Open	Closed	Preset 5 – P2-05
Closed	Open	Closed	Preset 6 – P2-06
Open	Closed	Closed	Preset 7 – P2-07
Closed	Closed	Closed	Preset 8 – P2-08

The parameters used in menu 9 to configure preset speeds are as follows:

P9-10	Speed source 1	0: Analog input 1.
P9-11	Speed source 2	1: Analog input 2.
		2: Preset speed (P9-21, P9-22, P9& -23).
P9-12	Speed source 3	3: Keypad speed (digital pot).
P9-13	Speed source 4	4: PID.
		5: Master speed.
P9-14	Speed source 5	6: Fieldbus speed.
P9-15	Speed source 6	7: User speed reference.
		8: Frequency input
P9-16	Speed source 7	9: Preset speed 1
		10: Preset speed 2
		11: Preset speed 3
P9-17	Speed source 8	12: Preset speed 4
		13: Preset speed 5
		14: Preset speed 6
		15: Preset speed 7
		16: Preset speed 8
P9-18	Speed select input 0	OFF, Digi-1 to Digi-8, Aout-1, Aout-2
P9-19	Speed select input 1	Dout-1 to Dout-5, On,USEr-1 to USEr-9
P9-20	Speed select input 2	
P9-21	Preset speed select input 0	OFF, Digi-1 to Digi-8, Aout-1, Aout-2
P9-22	Preset speed select input 1	Dout-1 to Dout-5, On,USEr-1 to USEr-9
P9-23	Preset speed select input 2	

The Optidrive HVAC has up to eight Speed Source parameters (P9-10 to P9-17). The Speed Source parameter values can be individually configured (set) to select different speed reference signals for the drive. Any one of these speed sources can be set to allow preset speed operation.

The different speed reference signals can then be selected based on the settings of the Speed Select Input parameters (P9-18 to P9-20). These three binary values select which of the eight Speed Source Reference parameters is currently active, as shown below.

Speed select input			
Speed select input 0 (LSB) (P9-18)	Speed select input 1 (P9-19)	Speed select input 2 (MSB) (P9-20)	Speed Source Parameter Active
Open	Open	Open	Speed source 1 – P9-10
Closed	Open	Open	Speed source 2 – P9-11
Open	Closed	Open	Speed source 3 – P9-12
Closed	Closed	Open	Speed source 4 – P9-13
Open	Open	Closed	Speed source 5 – P9-14
Closed	Open	Closed	Speed source 6 – P9-15
Open	Closed	Closed	Speed source 7 – P9-16
Closed	Closed	Closed	Speed source 8 – P9-17

When a speed source parameter is set to a value of 2, then that speed source is configured for preset speed mode. The actual preset speed that is then selected (P2-01 to P2-08) is then based on the values set in P9-21, P9-22, and P9-23.

When a speed source parameter is set to a value between 8 and 16 then the associated preset speed is selected directly once the speed source is selected.

Preset Speed select input			
Preset Speed select input 0 (LSB) (P9-21)	Preset Speed select input 1 (P9-22)	Preset Speed select input 2 (MSB) (P9-23)	Speed Source Parameter Active
Open	Open	Open	Preset Speed source 1 – P2-01
Closed	Open	Open	Preset Speed source 2 – P2-02
Open	Closed	Open	Preset Speed source 3 – P2-03
Closed	Closed	Open	Preset Speed source 4 – P2-04
Open	Open	Closed	Preset Speed source 5 – P2-05
Closed	Open	Closed	Preset Speed source 6 – P2-06
Open	Closed	Closed	Preset Speed source 7 – P2-07
Closed	Closed	Closed	Preset Speed source 8 – P2-01

Example Set-Up for Menu 9

The following application requires 4 preset speeds of the following values:

- Preset speed 1, 25Hz
- Preset speed 2, 33Hz
- Preset speed 3, 42Hz
- Preset speed 4, 50Hz

These are selected by two digital inputs.

The drive should run at a speed defined by the keypad up and down buttons whenever a dedicated digital input is activated (regardless of the selection of the preset speed digital inputs). The Start / Stop on the keypad should remain inactive (Run / stop controlled by a digital input).
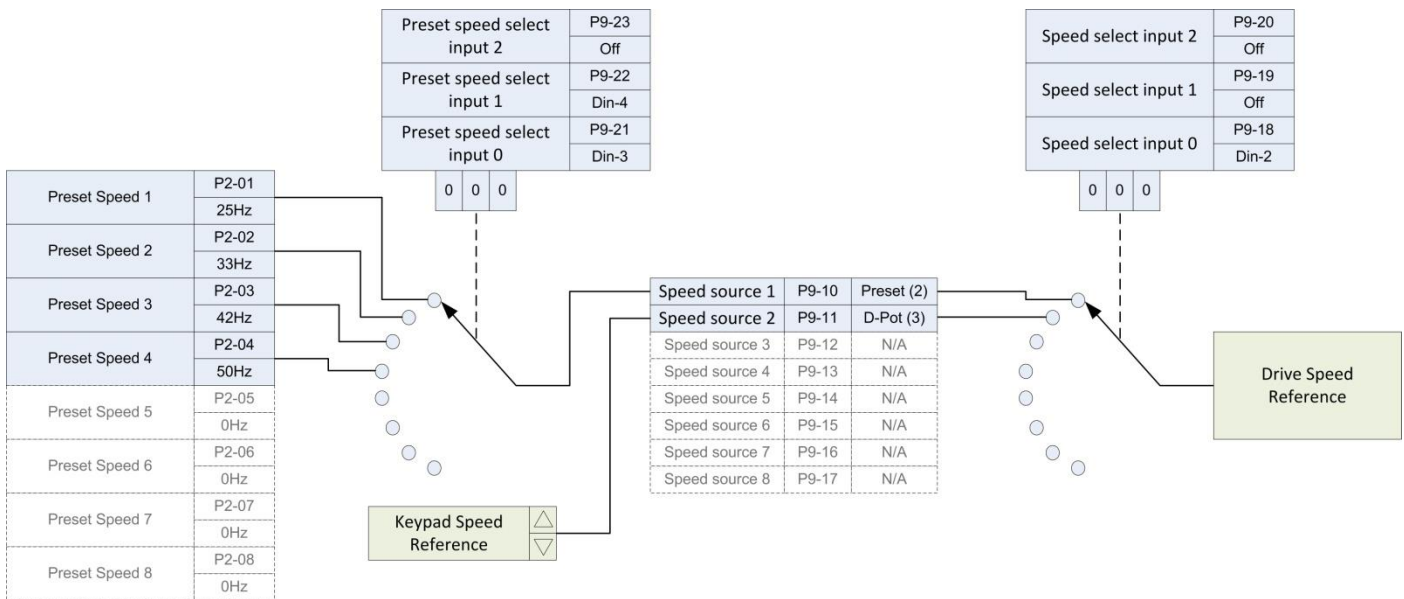
There should be a Run / Stop input to start and stop the drive.

A final input will provide an external trip to the drive.

The connection diagram for the drive is shown below:

1	Terminal 1: +24V Supply 24V @ 100mA
2	Terminal 2: Digital Input 1 Open=Stop : Closed=Run
3	Terminal 3: Digital Input 2 Open=Preset Speed 1-4 : Closed= Keypad Control
4	Terminal 4: Digital Input 3 Closed=Preset Speed selection – Bit 0 (LSB)
6	Terminal 6: Digital Input 4 Closed=Preset Speed selection – Bit 1 (MSB)
9	Terminal 9 : 0V Common
10	Terminal 10: Digital Input 5 Open=External Trip : Closed=OK to Run
12	Terminal 12 : Safe Torque Off STO -
13	Terminal 12 : Safe Torque Off STO +

Below is a parameter map showing the selection and values of the preset speeds.

The Following setting should be made to the drive.

The parameter settings listed are required *following a default of the drive* to factory setting. This should be performed prior to any programming to ensure all necessary default parameters are restored. Parameters listed in **Blue** are default values (do not require setting) but are listed in the table for clarity.

When the drive is changed from preset speed mode to keypad mode it copies the last operating speed (Set-point) across into keypad mode. This is part on the bump free Hand / Auto mode selection feature provided on the Optidrive HVAC. For example, if the drive is running at 33Hz (preset speed 2) and is switched to keypad mode the drive will stay at 33Hz until instructed from the keypad to change speed, regardless of speed it was last operating at when it was previously switched out of keypad mode.

Parameter	Description	Value	Notes:
P1-13	Digital Input Functions Select	0	Allows the inputs to be configured by the programmer through menu 9
P1-14	Extended Menu Access Code	201	Allows security level access is all parameter menus (security level 2)
P2-01	Preset Speed 1	25	Speed reference value when preset speed 1 is selected
P2-02	Preset Speed 2	33	Speed reference value when preset speed 2 is selected
P2-03	Preset Speed 3	42	Speed reference value when preset speed 3 is selected
P2-04	Preset Speed 4	50	Speed reference value when preset speed 4 is selected
P9-01	Enable Input Source	Din-1	Drive enables as digital input 1 is made
P9-03	Run Forward Input Source	Din-1	Drive runs forward as digital input 1 is made
P9-06	Reverse Enable	Off	Turned Off to prevent reverse operation
P9-08	External Trip input Source	Din-5	External trip input set by digital input 5 (Closed to run)
P9-10	Speed Source 1	Preset	Set for Preset Speed Operation
P9-11	Speed Source 2	D-Pot	Set to force speed reference to keypad control mode
P9-18	Speed Select Input 0	Din-2	Digital Input 2 set to control selection of Speed Source 1 or Speed Source 2
P9-19	Speed Select Input 1	Off	Turned off as not Required
P9-20	Speed Select Input 2	Off	Turned off as not Required
P9-21	Preset Speed Selection Input 0	Din-3	Digital Input 3 set to control Bit 0 of the Preset speed Selection
P9-22	Preset Speed Selection Input 1	Din-4	Digital Input 4 set to control Bit 0 of the Preset speed Selection
P9-23	Preset Speed Selection Input 2	Off	Turned off as not Required

Notes

	When a Run Reverse input is provided to the drive and a negative preset speed is selected it will result in the drive running in the forward direction. If is recommended, to avoid confusion, that reverse speeds are selected from a single source, either by setting negative preset speeds or by having a dedicated reverse input to the drive.

Appendix

Revision History			
Issue	Comments	Author	Date
01	New Application note created	JP	08/03/12
02	Updated to new format	KB	28/04/14