

**TYPICAL CONFIGURATIONS SD450**  
Two Wire Start/Stop with PID Control.

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**S/W PE 1.0 ver 0.3**

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## TYPICAL CONFIGURATIONS SD450

### Two Wire Start/Stop with PID Control.

#### 1.- Configuration Parameters

CODE	DESCRIPTION	DISPLAY	VALUE (DEFAULT)
APP-01	PID Enable Selection	Proc PID mode	(No). Set to yes to enable PID. PID screens will appear after se
APP-04	PID Aux Reference Mode Sel	Aux Ref Mode	(No). Yes
APP-05	PID Aux Reference Selection	Aux Ref Sel	(V1). Keypad
APP-06	PID Feedback Selection	PID F/B	(I) 4-20mA input
APP-07	P Gain for PID Control	PID P-gain	(1.0%). Proportional gain adjustment for the PID
APP-08	I Gain for PID Control	PID I-gain	(10.0 sec). Integral gain adjustment for the PID
APP-09	D Gain for PID Control	PID D-gain	(0.0msec). Differential gain adjustment for the PID
APP-10	High Limit Freq for PID	PID limit-H	(60Hz). High speed limit when in PID mode
APP-11	Low Limit Freq for PID	PID limit-L	(0.5). Low speed limit when in PID mode
APP-40	Sleep Delay Time	Sleep Delay	(60 sec). Adjust to suit desired delay prior to PID sleep
APP-41	Sleep Frequency	Sleep Freq1	(19.00Hz). Adjust for minimum speed to set system sleep
APP-49	Wake up level	WakeUp level	(35%). Adjust to suit level where PID control resumes
DRV-00	Command Frequency	0.00	(0.00). Adjust to set PID system set point value
DRV-01	Accl Time	Acc. Time	(20 sec). Adjust to suit
DRV-02	Decl Time	Dec. time	(30 sec). Adjust to suit
DRV-03	Str/Stp Control Mode	Drive mode	0 - Start/Stop via keypad 1 - Start/Stop via Fx terminal
FU1-30	Maximum Freq	Max Freq	(50Hz).
FU1-31	Motor Rated Freq	Base Freq	(50Hz).
FU1-60	Electronic Motor Thermal Model	ETH select	(YES).
FU1-61	Thermal Trip Level	ETH 1 min	(150%) * Screen only visible if FU1-60 = YES
FU1-62	Continuous motor thermal	ETH cont	(120%) * Screen only visible if FU1-60 = YES
FU1-63	Motor Cooling type	Motor type	(0 - Self Cooled)
FU2-40	Motor Power Rating	Motor select	(dependant on model) Enter closest motor kW
FU2-41	Motor Pole Rating	Pole number	(4) Enter number of motor poles
FU2-42	Motor Rated Slip	Rated-Slip	(auto based on FU2-40) * Enter slip frequency
FU2-43	Motor Rated Current	Rated-Curr	(auto based on FU2-40) * Enter nameplate current
I/O-07	I Input Minimum Current	I curr x1	(4.00mA). Scale to suit transducer
I/O-08	Freq corresponding to I Min	I freq y1	(0.0Hz). Scale to suit transducer
I/O-09	I Input Maximum Current	I curr x2	(20.00mA). Scale to suit transducer
I/O-10	Freq corresponding to I Max	I freq y2	(50.00Hz). Scale to suit transducer
I/O-87	User Unit Selection for I	V1 Unit Sel	(speed). Adjust to suit system variable i.e kPa for pressure

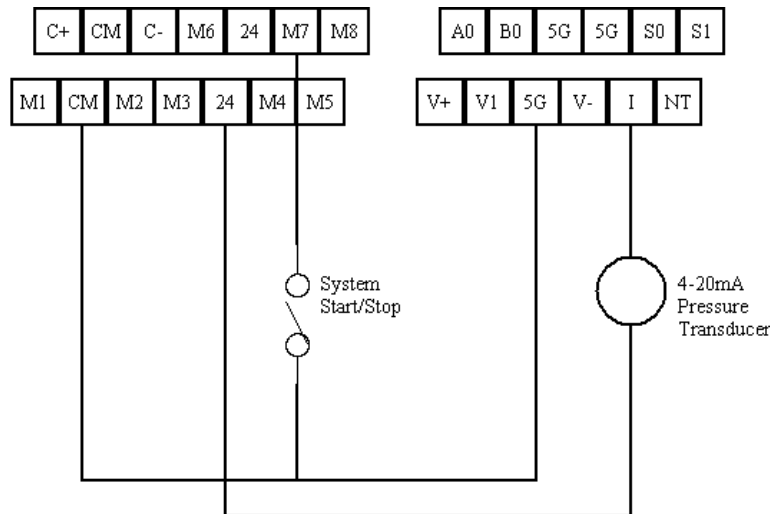
denotes minimum necessary adjustments.

(xx) denotes SD450 default value

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### 2.- Control terminal connections.

Terminal CM	: Common
Terminal M7	: Start/Stop (Input pre-configured)
Terminal I	: 4-20mA Analogue Input (Input pre-configured)
Terminal 5G	: 4-20mA and 0-10VDC Analogue Input Common
Terminal 24	: 24VDC +



### 3.- Notes for easy SD450 PID setup.

- Always configure parameter APP-01 (PID enable selection) to yes at the beginning of commissioning. Many of the screens associated with the SD450 PID control are not displayed until the PID is enabled.
- The required system pressure setpoint must be entered into screen DRV-00.
- If using the SD450 on a submersible pump ensure that the acceleration and deceleration parameters are adjusted to suit the pump manufacturer's required acceleration and deceleration rates
- Tuning the PID is achieved by making adjustments to parameters to APP-07, APP-08 and APP-09. These parameters allow tuning of the following:
  - APP-07 PID P Gain: Adjustment to the proportional gain ( $K_p$ ) of the PID is made by altering the value entered into this screen. As the proportional gain is increased the system responds more rapidly to changes around the setpoint. This results in the proportional error being smaller as the gain value is increased with the trade off being the system becomes less stable. PID P Gain value is set as a percentage value of the PID controller output

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versus the actual error value. Too higher value of proportional gain results in the PID overshooting and oscillating.

- APP-08 PID I time: Adjustment to the integral gain ( $K_i$ ) of the PID is made by altering the value entered into this screen. Whilst correct tuning of the proportional component of the PID loop can substantially reduce error it can never completely eliminate the error to a zero level. The  $K_i$  component of the PID loop can help reduce the system error to zero by adding an integral term to the control function. PID I gain value is set as the time in seconds that it takes for the PID controller output to reach 100% output when there is 100% error. Too higher value of integral gain (a low number of seconds) results in the PID overshooting and oscillating.
- APP-09 PID d time: Adjustment to the differential gain ( $K_d$ ) of the PID is made by altering the value entered into this screen. Adding a differential component to the PID loop is intended to improve stability, reduce overshoot and improve response speed by anticipating error. In the majority of pumping applications the  $K_d$  component is set to zero as this component is not required. PID D gain is set as a time in milli-seconds. The time value set is effectively a dampening period.
- A simple method for tuning PID control loops which is effective for the majority of applications is:
  - i. Set screens DRV-01 (Accel) and DRV-02 (Decel) to very high rates (e.g. 2sec) to ensure that they do not interfere with PID response time when tuning
  - ii. Set up system setpoint on screen DRV-00 as described previously
  - iii. Set the system so there can be a minimal flow (e.g. partly open a valve)
  - iv. Start the pump/motor and increase the value in screen APP-04 (PID P Gain). Continue increasing this value until oscillation of the pressure feedback signal (viewed on screen DRV-18) occurs. Adjust the value in screen APP-07 to 40% of this value.
  - v. With the pump still operating and the new value entered into screen APP-07, decrease the value in screen APP-08 (PID I time) until oscillation of the pressure feedback signal occurs. Adjust the value in screen APP-08 to 150% of this value.
  - vi. Adjust the value in APP-09 (PID D time) to 0.