

Control Devices PWMHS4XY Parallel Output Joystick Technical Manual

Revision 1.1

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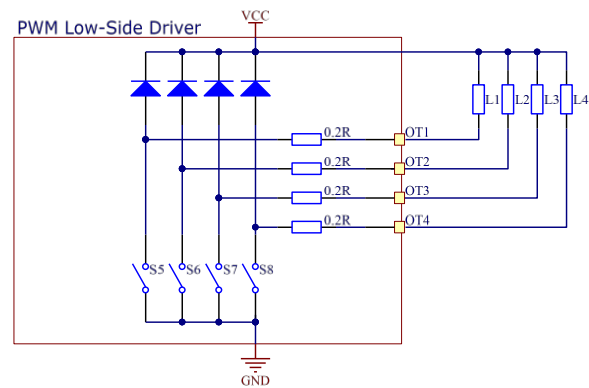
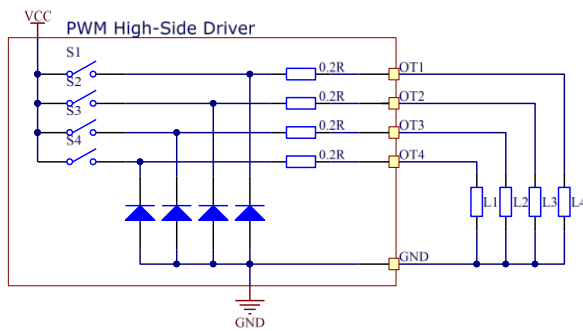
1 Revision Table

Revision	Date	Comment

2 Definition of Terms

HSXY4 – High-Side driver 4 valve solenoids outputs

LSXY4 – Low-Side driver 4 valve solenoids outputs



3 Introduction

PWMHSXY4 Joystick is dual XY axis joystick to operates in direct current (open loop) mode or constant current mode. It has up to four proportional solenoids (valves) operating High Side load configuration. Linear change input signal from joystick's handle changes duty cycle at set PWM carrier frequency. Provided computer interface software is for user to change each channel settings and monitor in real time machine operation.

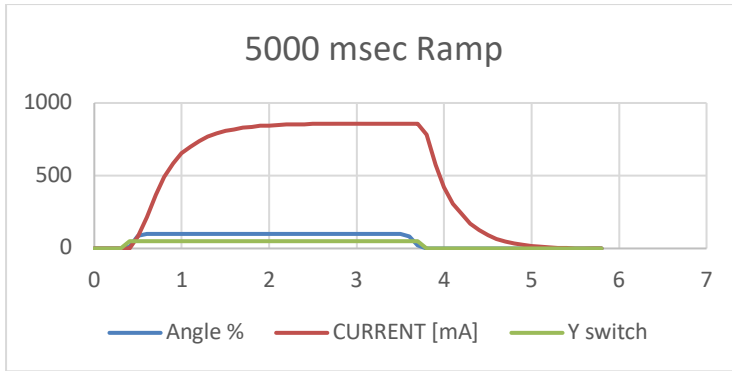
- All kinds of resistive and inductive loads (relays, electromagnetic valves).
- Track drive with a double acting spool and hydraulic motor per track.
- Microprocessor compatible power switch for 12 and 24 V applications.
- Solenoid control switch in automotive and industrial control systems.
- Robotic controls.

4 Features

Technical Specification:

Configurable parameters from software with manufacturing defaults values are:

- Supply 12V (range 9V to 30V).
- Solenoid's supply 12V (available on request using separate supply 5V – 40V).
- Output Infineon driver is especially designed to drive inductive loads (relays, electromagnetic valves) Integrated clamp-diodes limit the output voltage when inductive loads are discharged. It consists of:
 - Shorted Circuit Protection.
 - Overtemperature Protection.
 - Overvoltage Protection.
 - Electrostatic Discharge (ESD) Protection.
 - Green Product (RoHS compliant).
 - AEC qualified.
- PWM frequency set to 430 Hz (range 80Hz to 4KHz), for accurate constant current measurements.
- Dither Frequency set to 180Hz (range 33Hz to 200Hz) at 0.5% amplitude (range 0.1% to 3.0%). It eliminates sticking valve during the operation, makes smooth control.
- Set Minimum 150mA and maximum 600 mA joystick range (range 0 to 2500mA), safety proxy value at 200mA. Proxy operation by default is disable.
- Constant (default) or Direct Current mode operation.
- To reduce start up inrush current use, Start Delay from 0 to 1000msec is adjustable, 20msec default.
- Ramp up time constant is adjustable 0.01sec – 20 sec, using exponential step response method.



5 Default Settings

Default values are loaded for all output channels with the same value.

Table 1. Default Parameters

PARAMETER	VALUE
Control Mode	Direct Current (Open Loop)
Use Axis	XY
PWM Frequency	530 Hz
Dither Frequency	180 Hz
Dither Amplitude	0% - Disable
Start Delay	20 msec, with start surge
Handle Deadband	150 ADC 12BIT
Ramp Up/Down	100 msec
Minimum axis current	150 mA
Maximum axis current	600 mA
Proxy Safety Maximum	150 mA set at minimum value
Proxy Safety Enable	Disable

6 Joystick Wiring

Table 1 Joystick wiring for XY axis.

Wire No	PIN NUMBER	FUNCTION
1	GND	BOARD SUPPLY
2	+12V	BOARD SUPPLY
3	POWER	POWER SOLENOID
4	GNDP	GROUND COMMON SOLENOIDS
5	PROXY	SAFETY MAXIMUM SIGNAL
6	OT1	PWM 1
7	OT2	PWM 2
8	OT3	PWM 3
9	OT4	PWM 4

6.1 Parallel Output Configuration

AXIS	OUTPUT CHANNELS	WIRE NUMBERS
FORWARD	1 and 2	6 & 7
BACKWARDS	3 and 4	8 & 9
RIGHT	1 and 4	6 & 9
LEFT	2 and 3	7 & 8

Note: Each channel set to provide 0 -1A current.

6.2 Connecting to Joystick

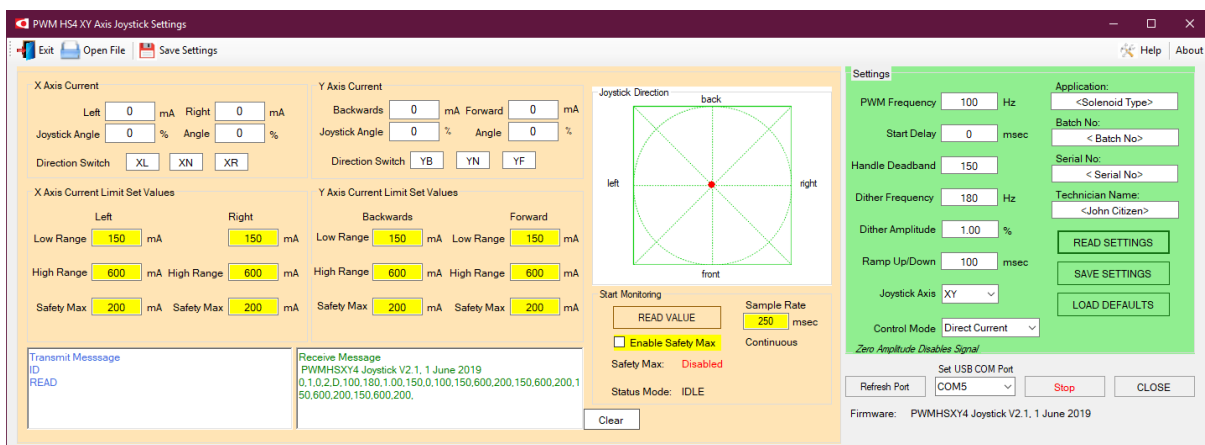
PWM Joystick program establish connection with serial USB COM port sending ID command. Joystick will response with software ID message. After user need read joystick's settings to update information, press READ SETTINGS button.

6.3 Saving settings

Settings are saved in the C:\PWM Joystick Settings\PWM_Settings.exe created by software file. Last saved settings are saved on the list top. SAVE SETTINGS button updates settings to joystick with reading back changes. LOAD DEFAULTS button restores manufacturing pre-set values.

6.4 Test Dual XY Axis

READ VALUE button press, starts monitoring current from connected solenoids. Joystick center is in neutral position XN/YN with 0% angle. Maximum 100% angles are at left, right, backward and forward directions showing High current value, which is set to High Range or to Safety Max.



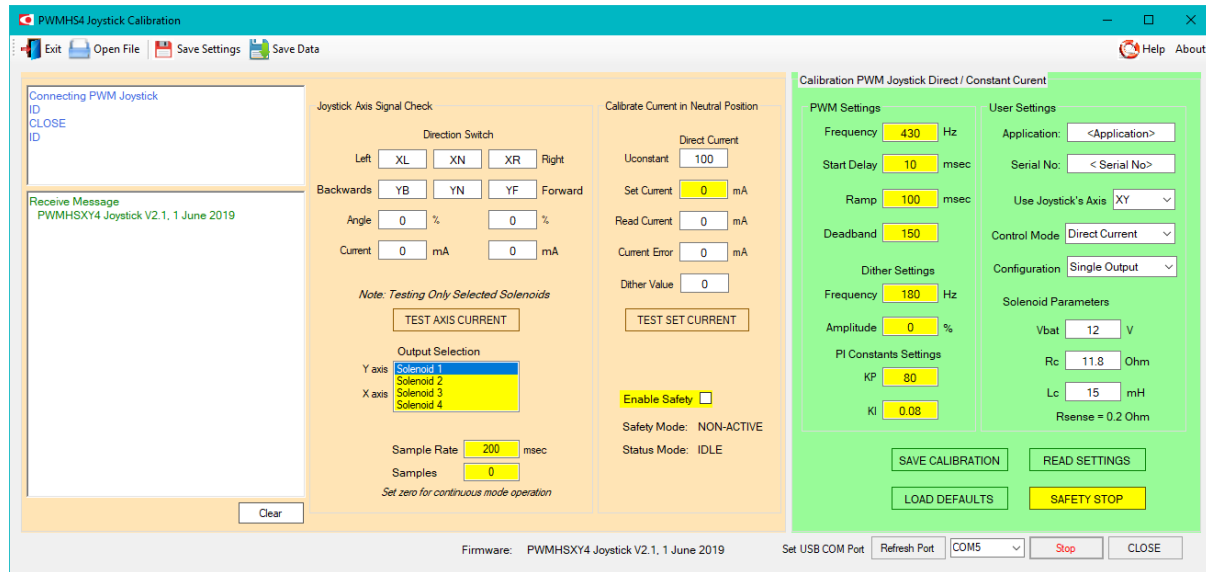
When Safety Max joystick input signal is activated it showing Safety Max set current value. To restore High Current value Joystick must be back to neutral (center) position to avoid sudden power inrush.

Start Delay in 50 milliseconds sets full power solenoid for the joystick moving from neutral center position. Handle Deadband is set for the joystick neutral position angle tolerance, which can be change as well with handle incoming vibrations from the machine.

Ramp Up provides additional response delay for the joystick signal setup in milliseconds. Zero value disable function, set as default.

6.5 Joystick Calibration

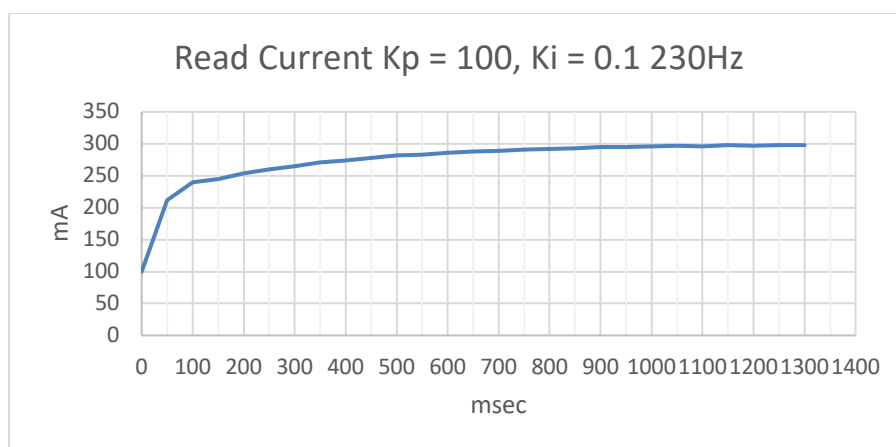
Joystick is pre-calibrated for constant current operation mode with calibration software, PWMCalibration.exe. Calibration each solenoid is done separately for Kp and Ki constants, PI controller values.

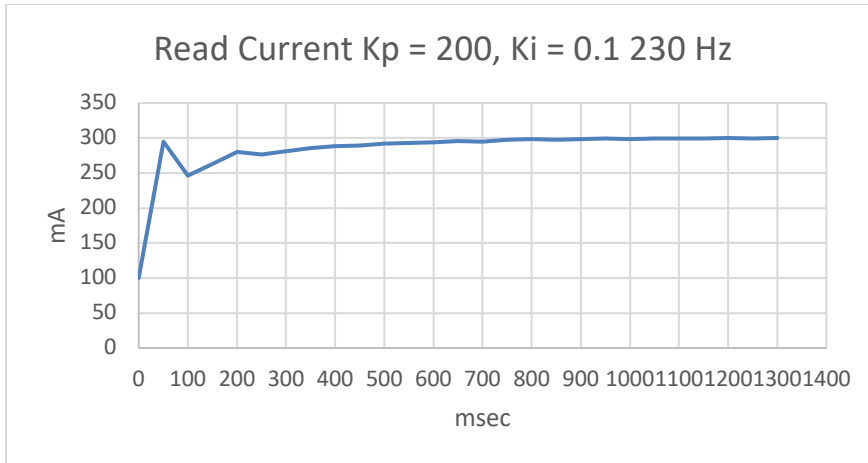


Before press TEST CURRENT button read first from joystick settings, press READ SETTINGS. Change set current value to high set range and press TEST CURRENT to maintain step change value.

Calibration set current should be done with Safety Max current disable option. After reading samples current changing back to at joystick position operating current.

By observing response time and final error user can determine optimum values. Save data to Excel file to make characteristics, press Save Data button.





Too high Kp can cause oscillations and too low Ki value larger current error.

Correct calibration's settings are saved in C:\PWM Joystick Settings\PWMCalibration.txt file, press Save Settings button.

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Application: <Application>
Serial No: <Serial No>
Solenoid No. = Solenoid 3
PWM frequency = 430 Hz
Dither frequency = 180 Hz
Dither amplitude = 0.5 %
Start Delay = 20 msec
Battery = 12 V
Sense = 0.2 Ohm
Rs Solenoid = 11.8 Ohm
Lc Solenoid = 15 mH
KP constant = 250
KI constant = 0.1
