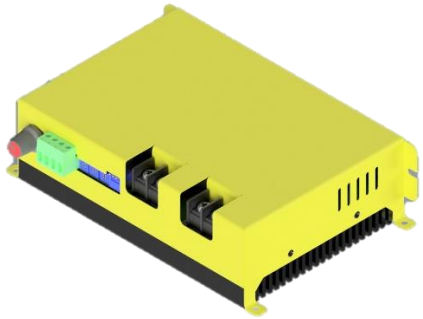
Product Description

CHERRY_HPS Motor Driver is one of the members of CHERRY family of Permanent Magnet DC(PMDC) motor drivers. CHERRY_HPS Enjoys smart Sensor-less Speed and Torque control of PMDC motors up to the power range of 1300W.

The speed control can be done in Open-loop and closed-loop fashions based on the desire of the users. Closed-loop sensor-less speed control enables the users to take the maximum advantage of their Motor by fixing the speed under variation of load without the need to any external Encoder or mechanical speed sensors which reduces the cost and size of applications considerably.

Power Range

Supply Voltage Range	12 – 48 VDC
Peak Current	60A
Continues Current	30A



Features

- Extremely easy to use
- Four Quadrant Regenerative Operation
- Configurable Speed and Current Limits
- Programmable Speed Gain settings
- Reverse Polarity Protection
- Over Current Protection
- Output Short Circuit Protection
- Open Loop and Closed Loop control
- Sensor-less PMDC speed control
- Nested Embedded Speed-Torque Loop
- Automatic Torque Loop Tuner
- Automatic Electrical Identifier of Motor Parameters
- Tunable Acceleration/ Deceleration
- 32-bit Processing Unit

MODES OF OPERATION

- Open-Loop Speed Control
- Sensor-less Closed-Loop Speed Control

COMMAND SOURCE

- 0-10V Analogue Speed Input
- 10kHz PWM Speed Input
- External Potentiometer Input
- Manual Speed Potentiometer Mounted on the Driver
- Direction
- Current Limit
- Motor Identification
- Acceleration and Deceleration
- Speed Kp, Ki Gain Setting

Applications

- Industrial Automation
- Traction units and vehicles
- Tracking, Pan & Tilt systems
- Automatic Guided Vehicles (AGV)
- Robotics
- Electric Vehicles

POWER Specifications of CHERRY_XPS			
Description	**Units**	**CHERRY_HPS** CH048060SXXNANDXXXS	**CHERRY_LPS** CH048030SXXNANDXXXS
DC Supply Voltage Range	VDC	12-48	12-48
DC Bus Over Voltage Limit	VDC	60	60
DC Bus Under Voltage Limit	VDC	12	12
Maximum Peak Output Current	A	60	30
Maximum Continuous Output Current	A	30	15
Maximum Continuous Output Power	W	1331	665
Maximum Power Dissipation at Continuous Current	W	69	35
Internal Bus Capacitance	µF	6600	6600
Minimum Load Inductance	µH	50	50
Switching Frequency	kHz	20	30
Maximum Output PWM Duty Cycle	%	95	95

Control Specifications		
Description	**Units**	**Value**
Command Sources	-	0-10V Analogue, PWM, Direction, Internal Potentiometer, External Potentiometer
Modes of Operation	-	Open-loop speed control, Closed loop sensor-less speed control
Motors Supported	-	Permanent magnet DC motors (PMDC)
Hardware Protection	-	Reverser Polarity, over-current, output short-circuit
Current Loop Sample Time	µs	40
Velocity Estimator Sample Time	µs	40
Velocity Loop Controller sample Time	µs	40

Mechanical Specifications		
Description	**Units**	**Value**
Size (H x W x D)	mm	52 × 190×121
Weight	g	1500
Form Factor	-	Panel Mount, Wall Mount
IP Rating	-	
COMMAND Connector	-	4-pin, 5.08 mm spaced, enclosed, screw lock header
SETTINGS Piano Switch	-	3-pin, Piano switch
POWER Connector	-	2-pin, 9.50 mm spaced, screw lock header
SUPPLY Connector	-	2-pin, 9.50 mm spaced, screw lock header

Thermal Specifications		
Description	**Units**	**Value**
Heatsink (Base) Temperature Range	°C (°F)	0 to 65 (32 to 149)
Storage Temperature Range	°C (°F)	-40 to 85 (-40 to 185)
Cooling System	-	Natural Convection

Compliances	
Type	**Details**
ROHS	Compliant with the requirements of the RoHS II Directive 2011/65/EU, restricting the use of certain substances including lead, mercury, cadmium, hexavalent chromium and halogenated flame retardants PBB and PBDE in electronic equipment
CE	Compliant with the requirements of Low Voltage Directive 2006/95/EC and of the harmonized standard EN 60204-1 on safety of electrical equipment of machines.

COMMAND Connector			
Pin	**Name**	**Description / Notes**	**I/O**
1	Direction	Sets the direction of rotation	I
2	Analogue	0-10V Analogue Speed Input	I
3	PWM	10kHz, 0-10v PWM Speed Input	I
3	+12V	+12V supply for External potentiometer	O
4	GND	Ground of the driver	-

SETTINGS Piano Switch			
Pin	**Name**	**Description / Notes**	**I/O**
1	Mode Setting	Mode selection, Open-loop or Closed-loop	I
2	Current Limit1	Current Limit bit 1	I
3	Current Limit2	Current Limit bit 2	I

POWER Connector			
Pin	**Name**	**Description / Notes**	**I/O**
1	Motor+	Motor output1	O
2	Motor-	Motor output2	O

SUPPLY Connector			
Pin	**Name**	**Description / Notes**	**I/O**
1	SUPPLY+	Positive port of Bus Voltage Input	I
2	SUPPLY-	Negative (Ground) port of Bus Voltage Input	I

PIANO SWITCH Functions:

Switch	Description	PIN1	PIN2	PIN3
1	Open-Loop operation of the Driver	OFF[1]	X[2]	X
2	Closed-Loop operation of the Driver	ON[3]	X	X
3	Current Limit – **30A**	X	OFF	OFF
4	Current Limit – **20A**	X	OFF	ON
5	Current Limit – **10A**	X	ON	OFF
6	Current Limit – **5A**	X	ON	ON

[1] - "OFF" condition is when the switch is Pushed Up
[2] - "ON" condition is when the switch is Pushed down
[3] - "X" refers to unimportant

Theory of Operation:

CHERRY_HPS is one of the members of CHERRY family of PMDC motor drivers with an innovational approach toward controlling motors easier and simpler with the maximum efficiency and technology available.

CHERRY_XPS has unique features which enables it to help its users to experience a different interaction at higher level of technology when working with permanent magnet motors with only one input to control the speed of a PMDC in closed-loop fashion. This is highly simpler, easier and at the same time much more advanced than most of the old-fashioned currently existing PMDC drivers in the market.

What makes CHERRY_XPS a different product is the smart sensor-less speed control feature which enables the users to control their systems without the need to mechanical sensors such as Encoders, Hall sensors or Tachometers and finally keeping the speed stable during the variation of the load on the Motors which is the case in almost all the systems interacting with environment.

The Closed-loop Sensor-less (CLSL) speed controlling feature combined with an innovative automatic motor parameter Identification, makes the whole control very simple with minimum user interference, the identifier automatically tunes all the requested parameters necessary for a safe and robust torque control based on the connected Motor to the driver, and the user only needs to tune two simple potentiometers which tunes the speed controller loop.

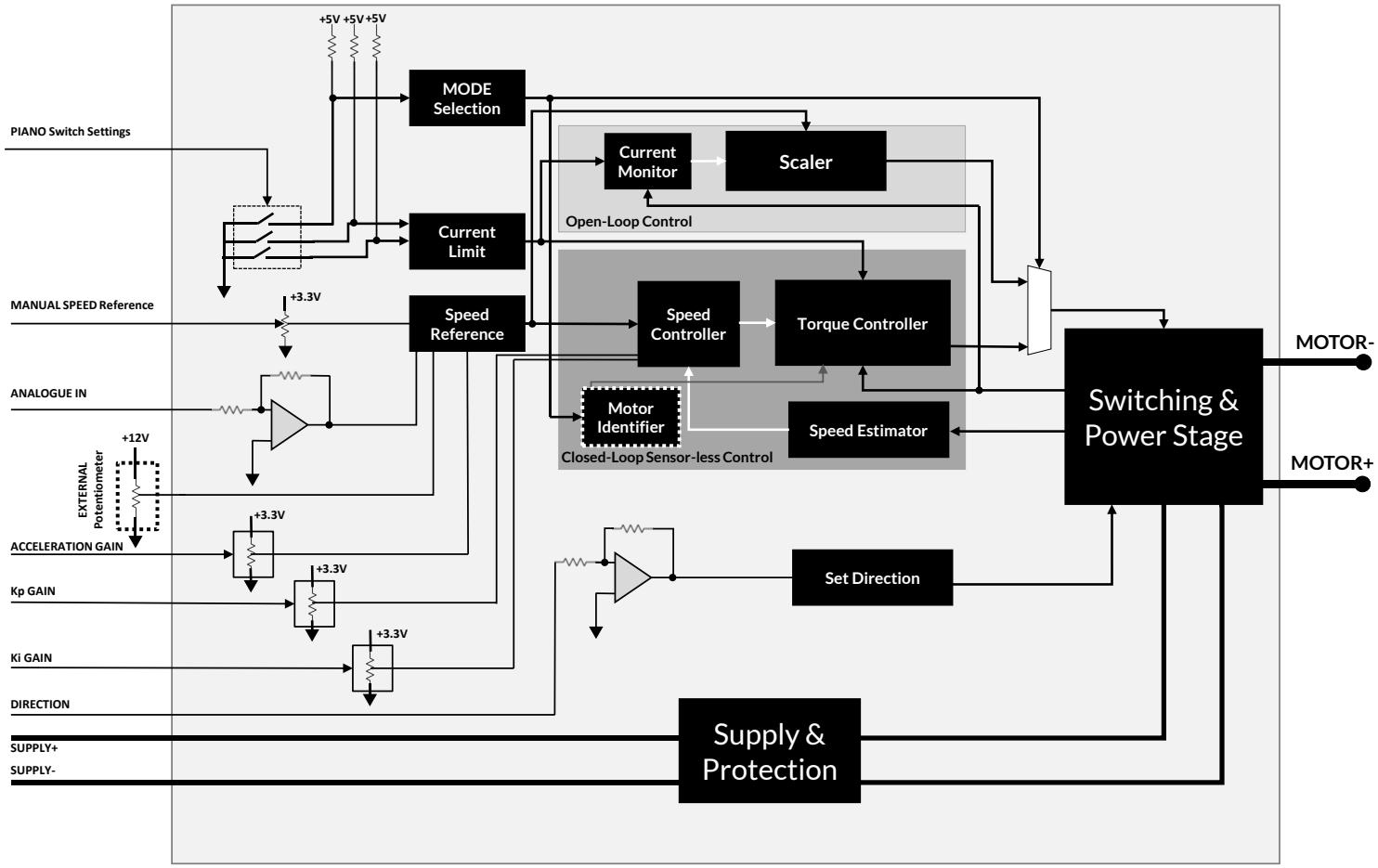
Beside all these features the users can ignore the closed-loop control with sensor-less feature and using this driver as a simple open-loop driver which they can control the speed of the Motor by one of the following 4 main methods:

1. Mechanical Speed Potentiometer mounted on the driver
2. 0 to +10V Analogue Input for Speed
3. 10kHz PWM input of 0-10V
4. External Potentiometer

All the mentioned inputs can be used both in open-loop or closed-loop operations with identical behavior.

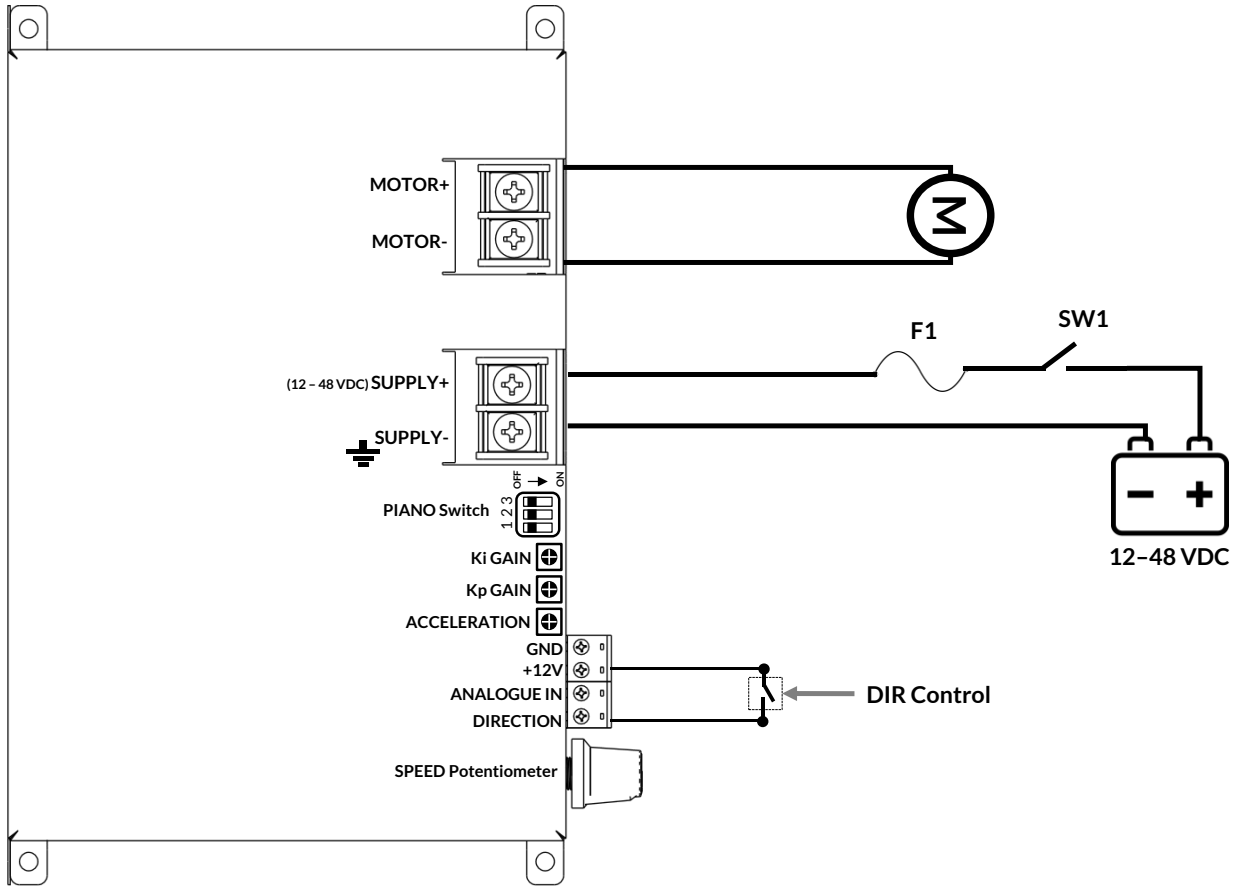
There is also a setting considered on the CHERRY_HPS which enables the users to define the maximum allowable current on the output of the Driver to the Motor starting from 5Amps up to 30Amps in 4 different steps.

Functional Block Diagram



Minimum External Wiring

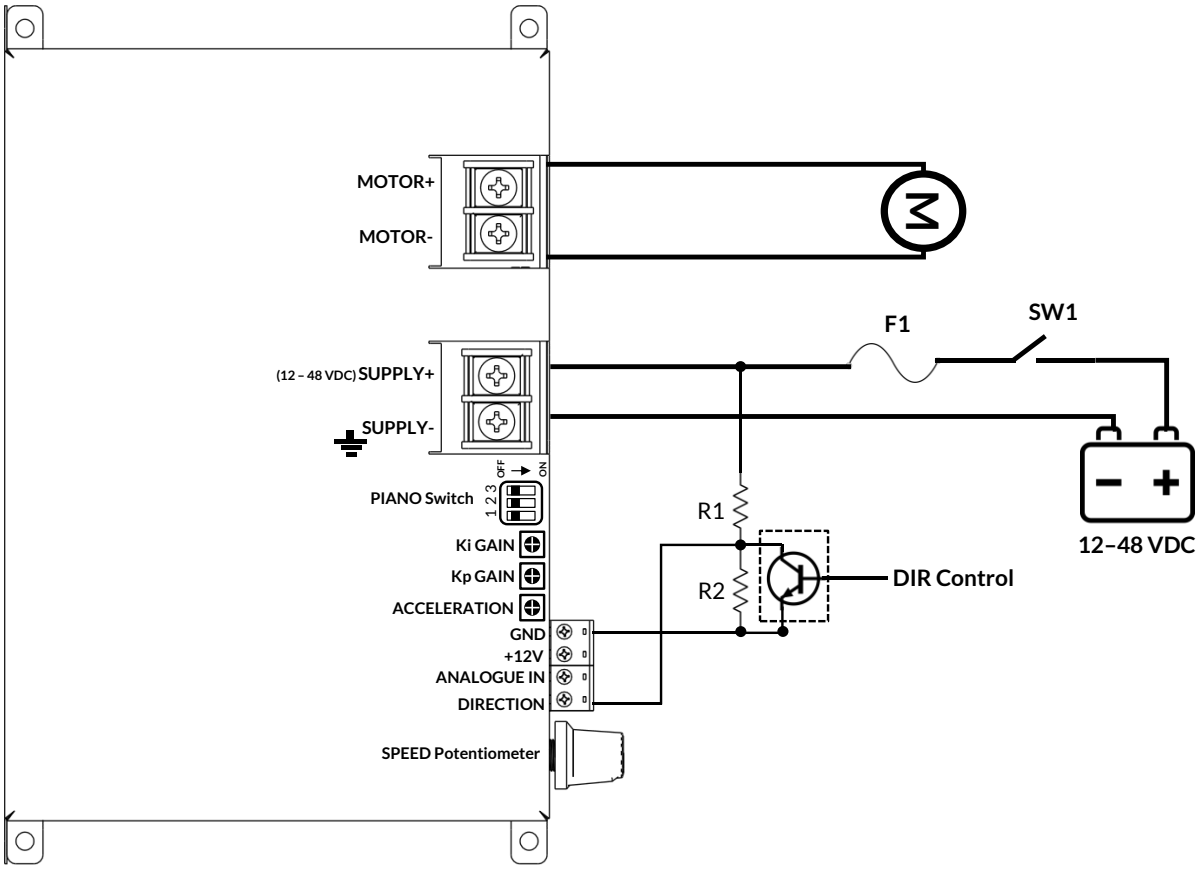
The minimum required wiring for running CHERRY_HPS is presented below. For Further information please read the CHERRY_XPS user-manual.



- "F1" is the external fuse, which can be dimensioned at maximum power as 60V, 65A
- "DIR Control", is the direction signal, by pressing the switch the Direction of the motor will be reversed

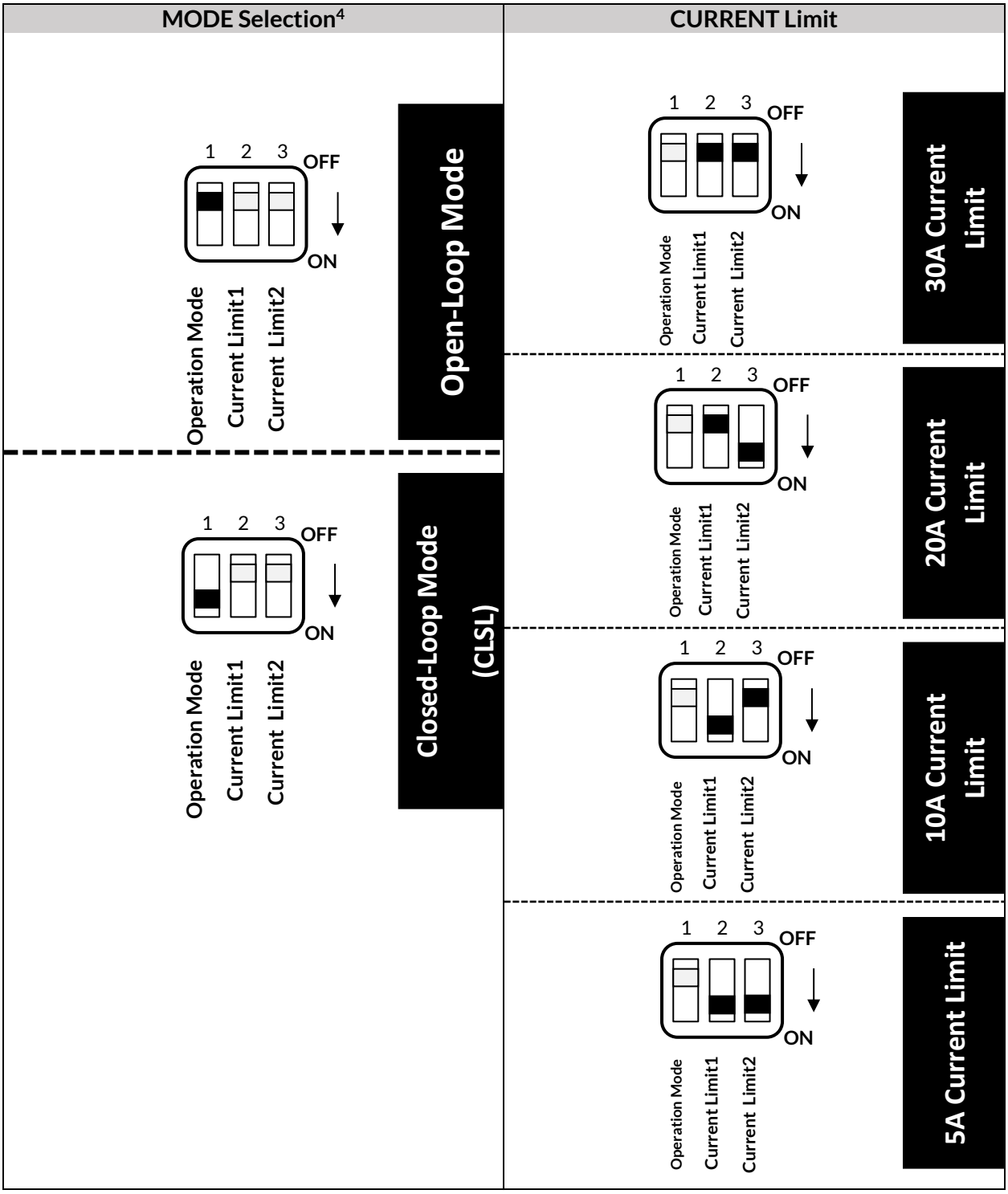
Direction Control with NPN Output

The minimum required wiring for running CHERRY_HPS with an NPN output for Direction control presented below. For Further information please read the CHERRY_XPS user-manual.



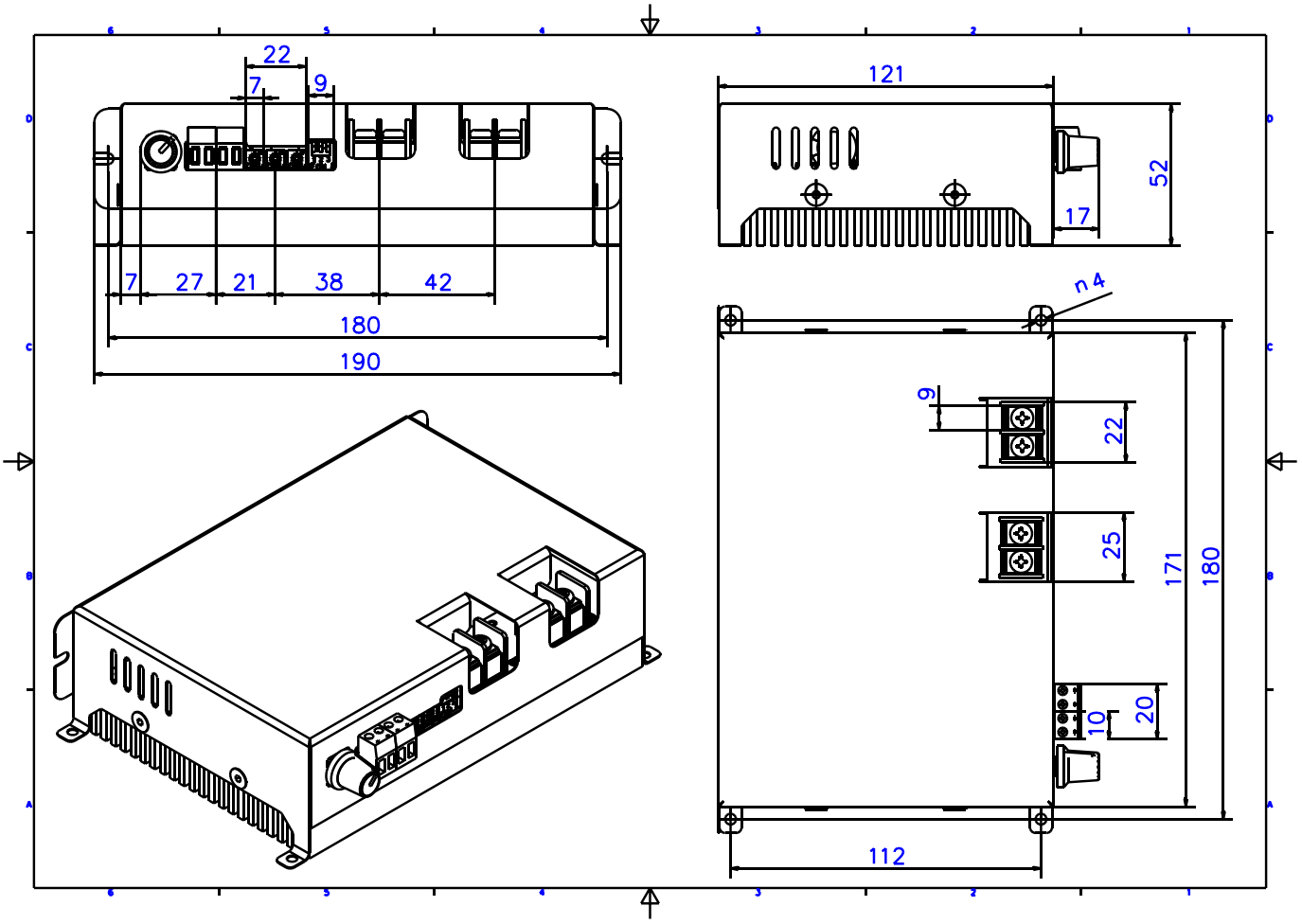
- "R1" = 15KΩ and "R2" = 10KΩ
- "DIR Control", is the direction signal coming from any digital controller or PLC
- The voltage on "DIRECTION" pin must not rise above 20V to avoid permanently damaging the driver.

PIANO Switch Settings

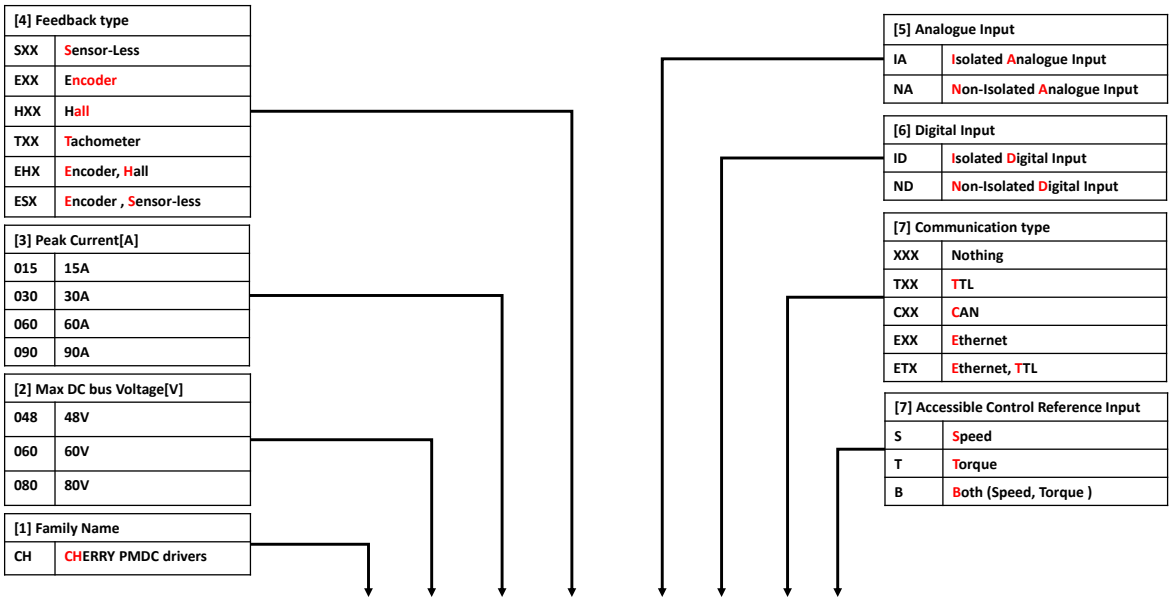


[4] "MODE Selection" and "CURRENT Limit" functionalities are independent from each other

Mechanical Drawings:



Product Coding and Part Numbering:



The CHERRY family products are categorized as below with their respective part numbering and main technical specifications.

CHERRY Family Products					
Description	**Units**	**CHERRY_HPS** CH048060SXXNANDXXXS	**CHERRY_LPS** CH048030SXXNANDXXXS	**CHERRY_HPT** CH048060SXXNANDXXXT	**CHERRY_LPT** CH048030SXXNANDXXXT
DC Supply Voltage Range	VDC	12-48	12-48	12-48	12-48
DC Bus Over Voltage Limit	VDC	60	60	60	60
DC Bus Under Voltage Limit	VDC	12	12	12	12
Maximum Peak Output Current	A	60	30	60	30
Maximum Continuous Output Current	A	30	15	30	15
Maximum Continuous Output Power	W	1331	665	1331	665
Maximum Power Dissipation at Continuous Current	W	69	35	69	35
Internal Bus Capacitance	µF	6600	6600	6600	6600
Minimum Load Inductance	µH	50	50	50	50
Switching Frequency	kHz	20	30	20	30
Maximum Output PWM Duty Cycle	%	95	95	95	95