HuanYang VFD Spindle Control

The HuanYang (HY) VFD is a popular choice for controlling both air and water cooled spindle motors. The HY comes in 220V and 110V versions and support spindles up to 2.2KW. The HY can be controller with front panel, a 0-10V signal, or an RS485 modbus*. **For new CNC users it is recommended to use the front panel to control the VFD as this provides the most flexibility.**

In this guide we will cover how to connect the HY VFD to the CNC xPRO V5 using the RS485 Modbus.

Setting up the VFD:

1) Download the manual for reference. https://github.com/Spark-Concepts/xPro-V5/files/6247012/Huanyang-VFD-manual.pdf . Follow instructions for wiring the VFD to the spindle, and to AC power. Reference section on how to properly change register settings.
2) Set the following registers:

Register	Value	Description
PD000	0	unlock parameters
PD001	2	Command source is RS485
PD002	2	Speed source is RS485
PD163	1	Communications address 1
PD164	1	9600 b/s
PD165	3	8 Bit No Parity - RTU
PD000	1	lock parameters

3) Verify the following registers:

Register	Description
PD004	Base frequency as listed on spindle (typically **400**)
PD005	Maximum frequency Hz (typical value for spindles is **400**)
PD011	Min speed (recommended air-cooled=**120** water=**100**)
PD014	Acceleration time (test to optimize)
PD015	Deceleration time (test to optimize)
PD023	Reverse run enabled (set to **1**)
PD141	Spindle max rated voltage (typically **220**)
PD142	Max rated motor current **(0.8kw=3.7, 1.5kw=7.0, 2.2kw=10)**
PD143	Motor poles (typically 2 or 4)
PD144	Rated motor revolution at 50Hz (typically 3000 @ 50Hz and 24000 @ 400Hz)

4) Power cycle the VFD

Setting up the CNC xPRO V5

1) Install the latest firmware
   a. For Normally Open Door Switches (or no door switch): xPro-V5/CNCxPROv5_XYYZ_NO.bin at main · Spark-Concepts/xPro-V5 (github.com)
   b. For Normally Closed Door Switches: xPro-V5/CNCxPROv5_XYYZ_NC.bin at main · Spark-Concepts/xPro-V5 (github.com)
   c. Load using these directions: Checking_firmware_and_upgrading · Spark-Concepts/xPro-V5 Wiki (github.com)

2) Define the spindle - $Spindle/type=HuanYang

3) Flip PWM / RS 485 switch to 485

4) Power cycle the xPRO

Connecting the CNC xPRO V5 to the HY VFD

1) Turn off CNC xPRO V5 and HY VFD!
2) Arrange CNC xPRO V5 and HY VFD near each other and so the RS485 cable length can be minimized. The VFD should be on the LEFT side of the xPRO such that cables go from the RS485 port toward the USB port and onward to the HY VFD.
3) Using twisted pair, or shielded twisted pair, connect the RS485 A port of the xPRO to the RS+ port of the HY VFD
4) Connect the RS485 B port of the xPRO to the RS- port of the HY VFS
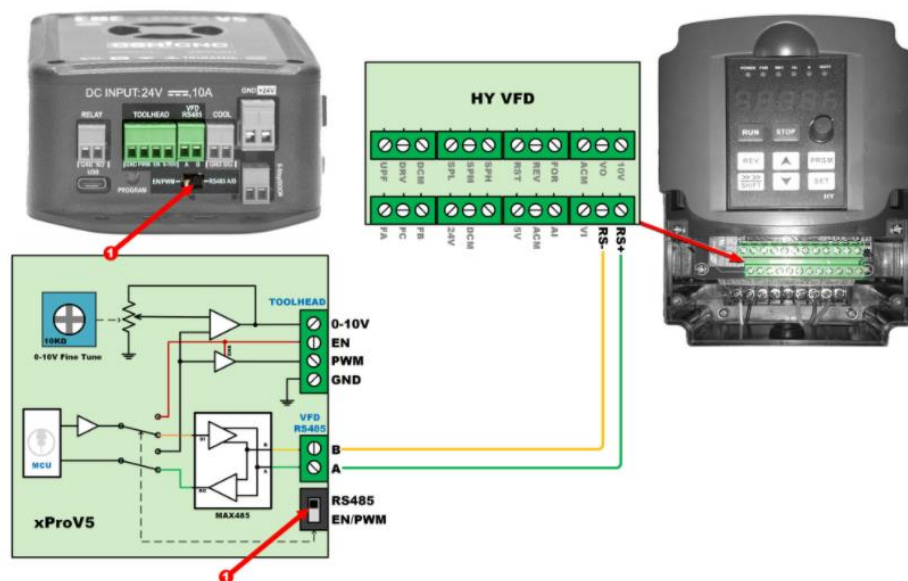
Using the HY VFD with the CNC xPRO V5 RS485 Control

1) It is recommended to setup the spindle using CNCjs to see all messages.
2) Turn on the HY VFD. Allow to fully start. This takes an unnaturally long time – roughly 20 seconds
3) Turn on the CNC xPRO V5, or press the reset button, or connect to the USB port. Key here is to have the firmware restart.
4) Confirm HY VFD connection in xPRO startup message. (just below the motor driver self-tests)/

```
[MSG:Initializing RS485 VFD spindle]
[MSG:Auto_RTS in use]
[MSG:VFD RS485  Tx:GPIO(4) Rx:GPIO(25) RTS:None]
[MSG:VFD: VFD settings read: RPM Range(3456, 11520)]]
```

5) Issue command M3 S5000
6) Check HY VFD display – this should read F 173.6

You are now all set! Happy Cutting

Troubleshooting:

1) **Spindle unresponsive error. Message looks like this and may repeat many times.**

```
[MSG:Spindle RS485 Unresponsive 8]
```

If this happens immediately after you start the xPRO:
1) Make sure the HY VFD is powered on before the xPRO.
2) Make sure the wires are correctly connected, tug gently on each wire to make sure it is fully seated and clamped.
3) Make sure the wires are not shorted at the connectors.
4) Check the LED under the PWM / RS485 switch – this should blink red and green. Red is the message output from the xPRO, Green is the message coming from the HY VFD
   a. If you see only a red light, check the register settings of the HY VFD
   b. If you see only a green light, check that the PMW / RS485 switch is fully seated on the 485 side and check $Spindle/Type = HuanYang

If this happens after you send an ON command (M3 or M4) you have a noise issue.
1) Make sure to route the VFD to Spindle wire well away from the RS485 lines.
2) Make sure to route the AC power lines well away from the RS485 lines.
3) Make sure the keep the 24V and Stepper motor lines well away from the RS485 lines.
4) Install a Ferrite choke (
https://github.com/Spark-Concepts/xPro-V5/issues/44#issuecomment-906941506)

2) **I make a movement command but the spindle starts but then stops moving.**
    a. This is an issue with the defined ramp up and ramp down time in the HY VFD registers.
        i. Increase value of PD014 and PD015 (repeat until tuned).
3) **Factory reset the HY VFD**
    a. When all else fails, a factory reset will work wonders on the HY VFD. Set PD013 = 08 then reapply the register settings at the beginning of this document.