title : Electronic diagram `TWT jetting grid` author: Dennis van Gils : https://github.com/Dennis-van-Gils/project-TWT-jetting-grid date : 19-11-2022 Rittal cabinet Purpose: Control 112 solenoid valves @ 24 V by a single Arduino. We will use two Centipede boards (only one shown), each providing 64 digital outputs controlled Rittal cabinet | lab environment USB cable USB panel mount
Bulgin px0840-b-5m00 Bulgin PX0844/B/0M50/B over I2C. Each Centipede board will have 4 Sanwo MOSFET boards connected to them, each providing 16 channels. Hence, there is a total of 8 Sanwo MOSFET boards to control in total 112 (max 128) solenoid valves. We will work in groups of 14, because 8x14=112. Also, each of the 4 sides of the tunnel will house 2x14=28 valves. USB B USB isolator USB A Cable management is easier this way. Hence, instead of populating all 16 channels per MOSFET board, we occupy only the first 14. pressure manifold #1 bulkhead connector | cable connector pressure from cable connector bulkhead connector N.C. Ø I17 N.C. Ø I16 Harting 19 41 024 0301 | Harting 19 41 124 0523 perfboard Close the jumper to power the Harting 19 41 124 0523 Harting 19 41 024 0301 jetting pump Y16 Ø N.C. & 7x insert 09 14 005 2701 | & 7x insert 09 14 005 2601 solenoid valve 0 0 0 00000000 00000000 Feather externally. WARNING: & 7x insert 09 14 005 2701 & 7x insert 09 14 005 2601 Ø 115 RPE 5105NC-Do not connect to USB in that V 9 5 4 8 7 H 0 Ø 110 Ø 111 Ø 113 Ø 115 USB I2C I/O expander, 64 ch. Y14 Ø case to prevent back-powering Macetech Centipede V2 Y13 Ø 24 V, 265 mA the USB port at the PC side. iso. front panel Arduino pass-through Y12 Ø +3V3 1 of 28 RESET (not connected) EXT. POWER Y11 Ø Y10 Ø iso. GND Y7 Ø Y6 Ø "Main MCU" Y5 Ø SAFETY PULSES Amphenol FC20600-0 Y4 Ø Adafruit Y3 Ø Y2 Ø O LM78xx OUT Feather D12 Safety_pulses M4 Express D11 LED data (3.3V) manifold D10 CS_pressure_1 #3857 ng CS_pressure_2 35 x 0.5 mm², OD 14.5 mm V+ Ø ▲ 24 VDC ÖLFLEX CLASSIC 110, 1119035 D6 CS_pressure_4 Sanwo 16 ch. ● GND over 16 ch. D5 CS_pressure_3 MOSFET board MODBUS RS485 (TxD+, TxD-, GND) USB-RS485 ——○ valve #1 CENTIPEDE modified for 3.3V TX_D1 opt. isolated 1 of 8 Titan USB-COMi-SI-I Half-duplex, no echo **DIP** switches N.C. Ø 117 Ø 116 Ø 115 Ø 114 Ø 113 Ø 112 Ø 111 pressure snubber VDC Omega PS-4E-MG Y16 Ø N.C. Arduino pass-through 4-20 mA S2: off Y15 O _(not connected) S3: off Y14 Ø S4: off 14 13 12 11 10 9 8 Y13 Ø Internal jumpers Y12 Ø Y11 Ø 000000 000000 pressure sensor #1 all open except GND 74AHCT125 1-2, 5-6, 11-12 Omega PXM309-007GI Y10 Ø ─ GND GND Ø 17 Ø 16 Ø 15 Ø 14 Ø 13 Ø 12 Ø 11 Ø 10 Y7 Ø Y6 Ø Y5 Ø Y4 Ø Y3 Ø Y2 Ø GND 3.3 iso. 5 GND VDC LED data (5V) 220 uF, 16 V LED data (3.3V) pressure manifold #2 connecto 2 of 4 (valves 29 to 56 & pressure sensor #2) $1000\ \mu\text{F}$ V- Ø GND V+ Ø △ 24 VDC 1 uF, 50 V \emptyset com -----Sanwo 16 ch. MOSFET board pressure manifold #3 connecto modified for 3.3V 3 of 4 (valves 57 to 84 & pressure sensor #3) POWER IN LEDS OUT 2 of 8 0000 read pressure 1 (4-20mA) 20mA R click pressure manifold #2 connecto 4 of 4 (valves 85 to 112 & pressure sensor #4) Safety circuit to enable the jetting pump power switch [active receiver Arcolectric c1353algnf (provides 16 VDC) Color code cables Harting bulkhead connector USB fuse SIGNAL pin# cable# valve# iso. front panel RESET cable connector bulkhead connector mosfet 1-Y0 Harting 19200031440 Harting 09200030301 mosfet 1-Y1 wall power mosfet 1-Y2 Pump relay 230 VAC safety GN/WH mosfet 1-Y3 MCU" mosfet 1-Y4 Adafruit 24 VDC PSU 5 VDC PSU 3.3 VDC PSU 6 A, 30 W XP POWER + 31 A, 750 W 🕇 mosfet 1-Y5 Feather 2.6 A, 8.6W MO Basic GΥ mosfet 1-Y6 DNR30US05 GY/WH mosfet 1-Y7 wall GND Adafruit MOSI Non-Latching mosfet 1-Y10 10 B OR/WH mosfet 1-Y11 10 FeatherWing mosfet 1-Y12 11 Adafruit #2895 12 B GN/WH mosfet 1-Y13 12 mosfet 1-Y14 13 13 B BL/WH mosfet 1-Y15 14 14 B mosfet 2-Y0 15 15 C OR/WH mosfet 2-Y1 mosfet 2-Y2 17 GN/WH mosfet 2-Y3 18 18 C panel mount chassis 🛇 PANEL Phoenix 1424137 & 1440164 mosfet 2-Y4 19 BL/WH mosfet 2-Y5 20 plug & cable **| '#"#"#"#"**# Phoenix 1424107 mosfet 2-Y6 21 mosfet 2-Y7 22 GY/WH shielded cable 22 C mosfet 2-Y10 23 23 D socket panel mount connect shield to chassis of freq. inverter MODBUS RS485 (TxD+, TxD-, GND) OR/WH mosfet 2-Y11 24 24 D Phoenix 1404642 Phoenix 1424139 & 1440164 mosfet 2-Y12 25 25 D DATA . Jetting pump GND GND +5V X1 terminal RGB LED matrix L1,L2,L3,PE GN/WH mosfet 2-Y13 26 Frequency inverter NeoPixel 16x16 mosfet 2-Y14 27 27 D There are two microcontroller (MCU) boards used in the TWT jetting grid. The main MCU Xylem Hydrovar 4.075 Adafruit #2547 BL/WH mosfet 2-Y15 28 © 13 GX © 12 RS485.1P © 11 RS485.1N © 10 GND Q 26 GX Q 25 RS485.2P Q 24 RS485.2N (Adafruit M4 Feather Express) is responsible for driving the solenoid valves and LED matrix 4-20 mA (+) 29 pressure OR and communicates via USB to the Python main program running on a PC. The **second MCU** 30 pressure OR/WH 4-20 mA (-) water pressure Q 23 GND Q 22 FAN.CTRL (Adafruit Feather MO Basic) acts as a **safety controller**, governing the relay that allows Q 9 10v freq. inverter 31 ground turning the jetting pump on and off via terminal X1 of its frequency inverter. MS Ø 8 GND 3ph 400 VAC, I_{max} = 17 A 32 ground 20 SOLO.RUN Xylem Hydrovar 4.075 Q 19 GND Q 6 GND 33 ground 18 ON_OFF 17 GND 17 GND 16 LOW_WATER 15 GND **◯** 5 AI2 The main MCU should send a digital 'safety' pulse once every N ms over to the safety MCU motor jetting pump 34 ground Q 4 24 V 3ph 400 VAC, 10.5 A, 7.5 kW 6.8 kW, 2900 rpm, 60 m³/h as indication that the main MCU is still operating all right. As long as the safety MCU

Q 2 AI1

🛇 1 24 V

№ 14 D11

receives pulses within the set time period, the 'pump on' relay will be engaged.

ground

Lowara PLM 132 B5 7.5 kW Xylem Lowara 46SVH2N075T/4

BK

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