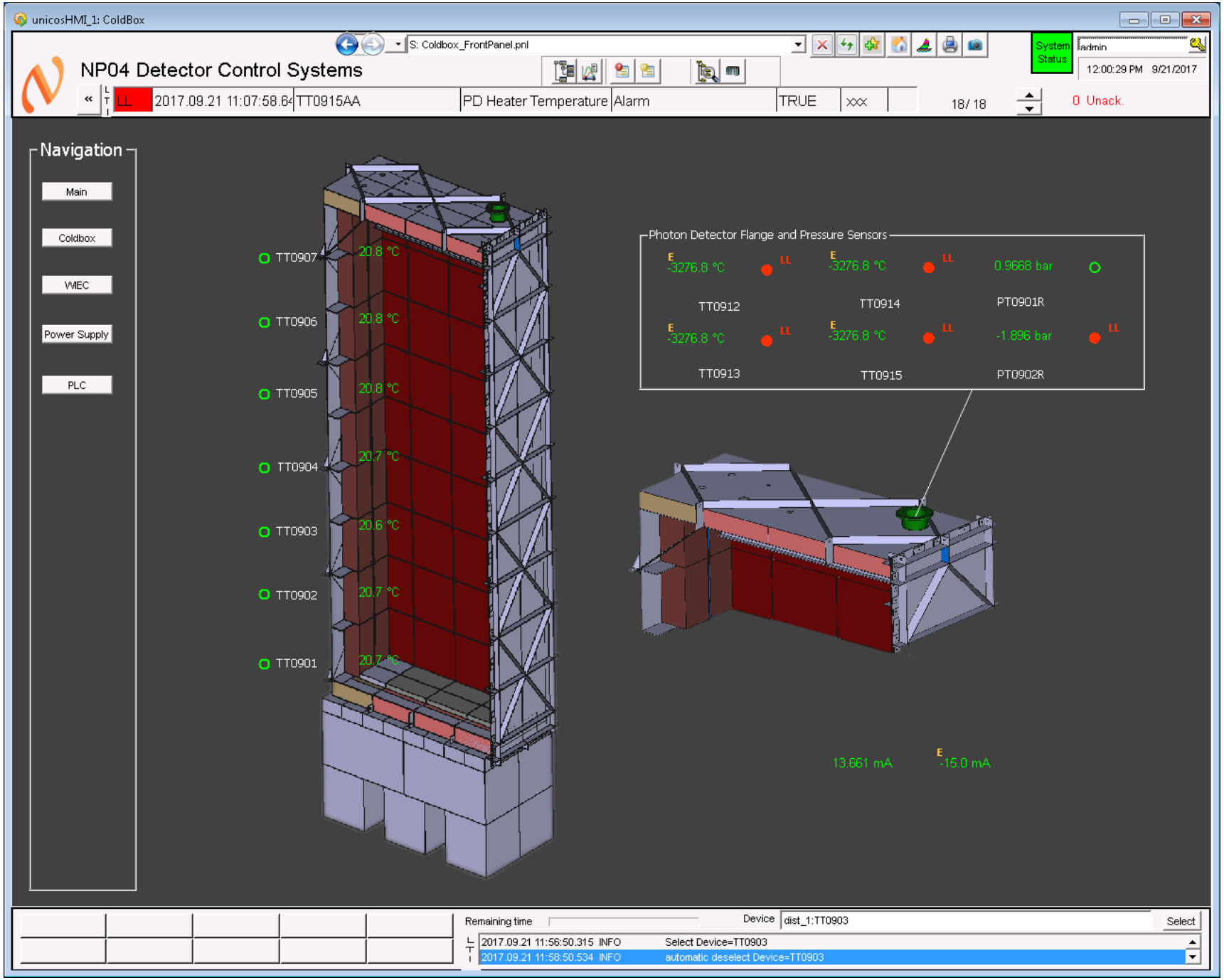
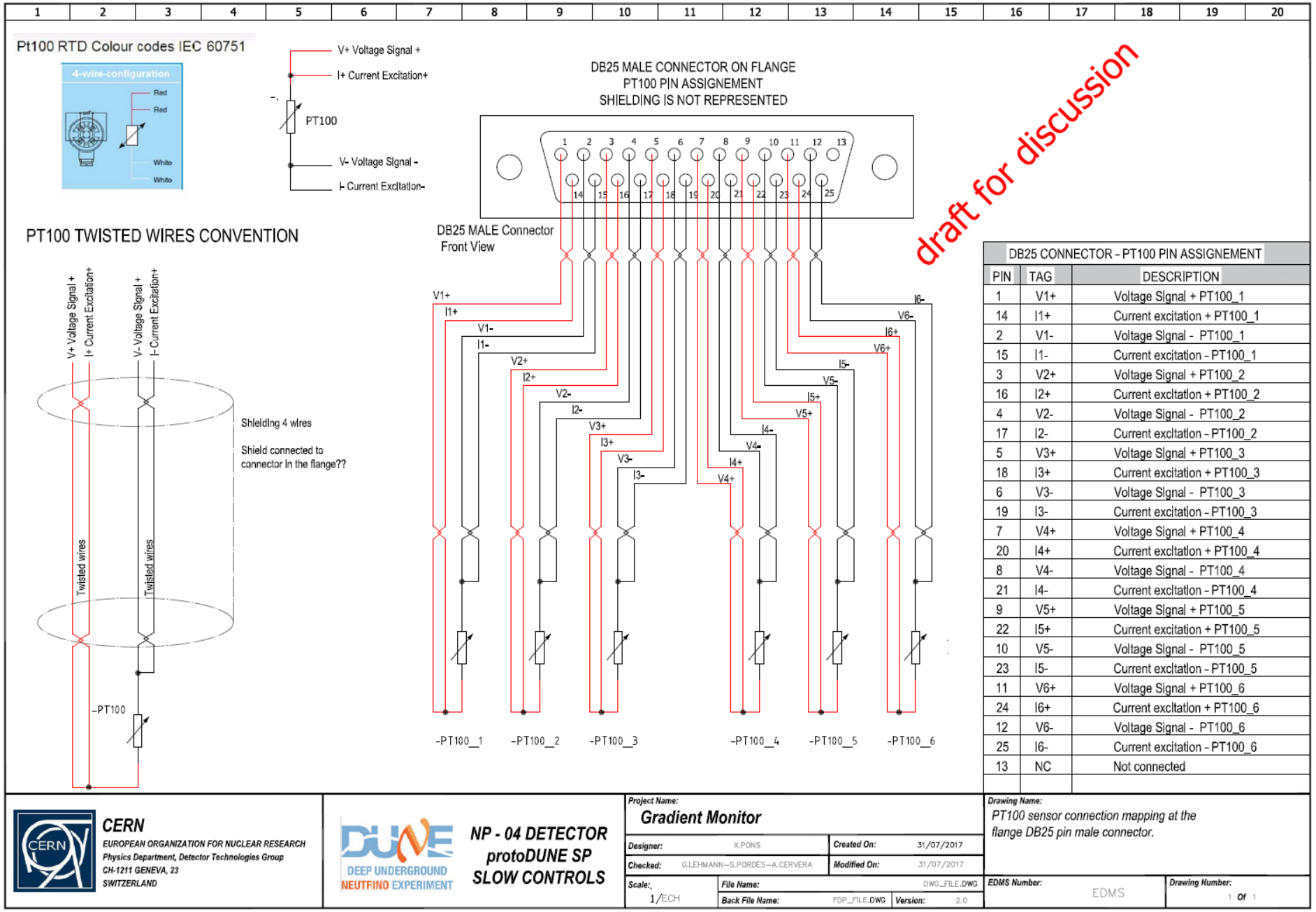
ProtoDUNE SP – PT100 Multiplexing board

Giovanna Lehmann – Xavier Pons
CERN 21/09/2017

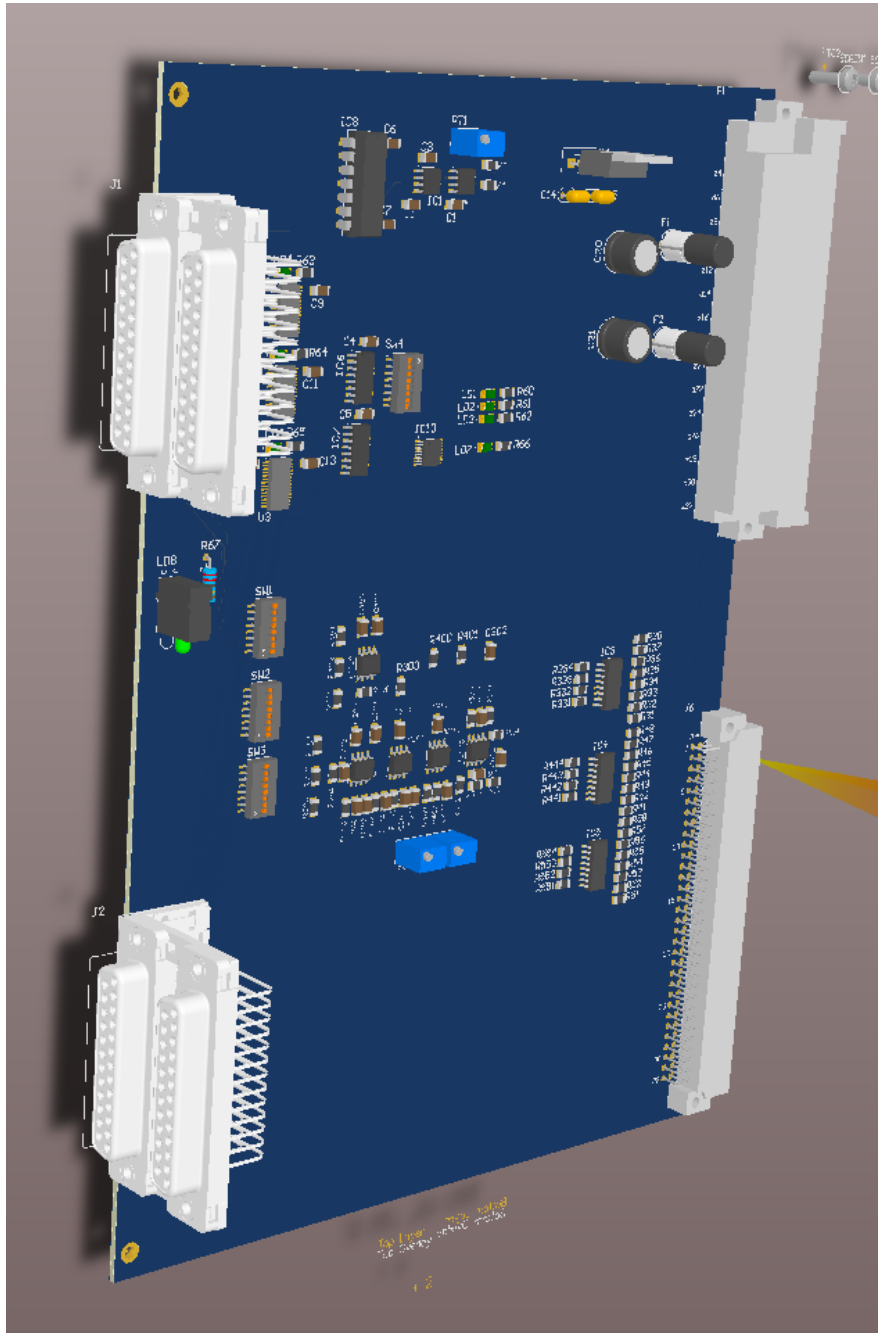

unicosHMI_1: ColdBox
S: Coldbox_FrontPanel.pnl
NP04 Detector Control Systems
System Status
admin
12:00:29 PM 9/21/2017
LL 2017.09.21 11:07:58.84 TT0915AA PD Heater Temperature Alarm TRUE xxx
18/ 18
0 Unack.
Navigation
Main
Coldbox
WIEC
Power Supply
PLC
TT0907 20.8 °C
TT0906 20.8 °C
TT0905 20.8 °C
TT0904 20.7 °C
TT0903 20.6 °C
TT0902 20.7 °C
TT0901 20.7 °C
Photon Detector Flange and Pressure Sensors
-3276.8 °C
TT0912
-3276.8 °C
TT0914
0.9668 bar
PT0901R
-3276.8 °C
TT0913
-3276.8 °C
TT0915
-1.896 bar
PT0902R
13.661 mA
-15.0 mA
Remaining time
Device
dist_1:TT0903
Select
2017.09.21 11:56:50.315 INFO Select Device=TT0903
2017.09.21 11:58:50.534 INFO automatic deselect Device=TT0903

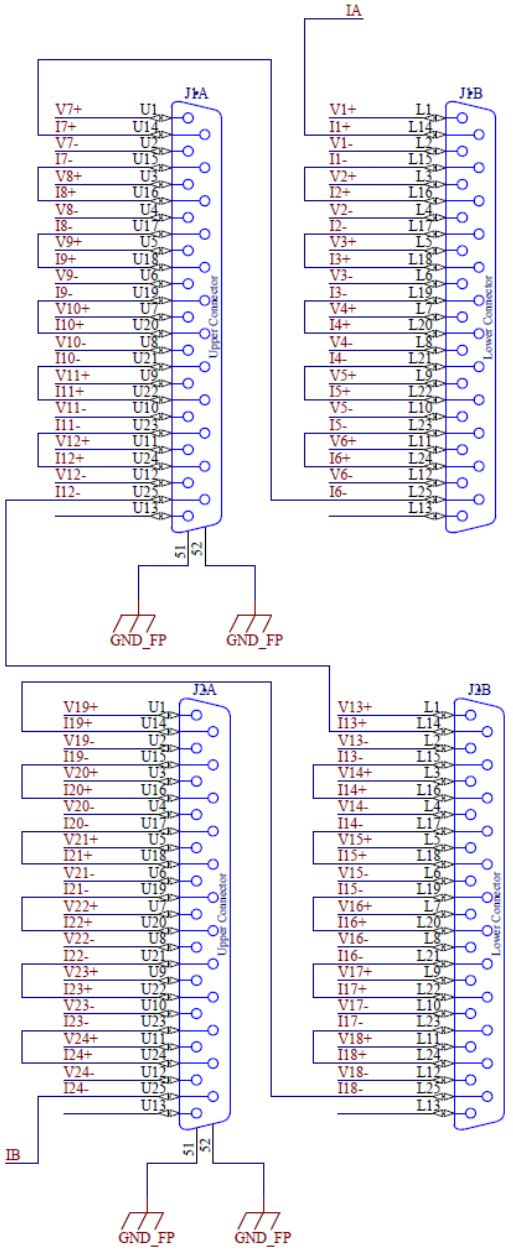


DB25 CONNECTOR - PT100 PIN ASSIGNEMENT		
PIN	TAG	DESCRIPTION
1	V1+	Voltage Signal + PT100_1
14	I1+	Current excitation + PT100_1
2	V1-	Voltage Signal - PT100_1
15	I1-	Current excitation - PT100_1
3	V2+	Voltage Signal + PT100_2
16	I2+	Current excitation + PT100_2
4	V2-	Voltage Signal - PT100_2
17	I2-	Current excitation - PT100_2
5	V3+	Voltage Signal + PT100_3
18	I3+	Current excitation + PT100_3
6	V3-	Voltage Signal - PT100_3
19	I3-	Current excitation - PT100_3
7	V4+	Voltage Signal + PT100_4
20	I4+	Current excitation + PT100_4
8	V4-	Voltage Signal - PT100_4
21	I4-	Current excitation - PT100_4
9	V5+	Voltage Signal + PT100_5
22	I5+	Current excitation + PT100_5
10	V5-	Voltage Signal - PT100_5
23	I5-	Current excitation - PT100_5
11	V6+	Voltage Signal + PT100_6
24	I6+	Current excitation + PT100_6
12	V6-	Voltage Signal - PT100_6
25	I6-	Current excitation - PT100_6
13	NC	Not connected

Gradient Monitor mapping at the SUB-D 25 pin connector at the top flange

- 6 PT100
- Polarities by twisted pair
- Mapping ready to use flat ribbon cable





6U size PT100 multiplexing board

2x2 SUB-D 25 pin female dual stacked connector

Dualport 25p F/F

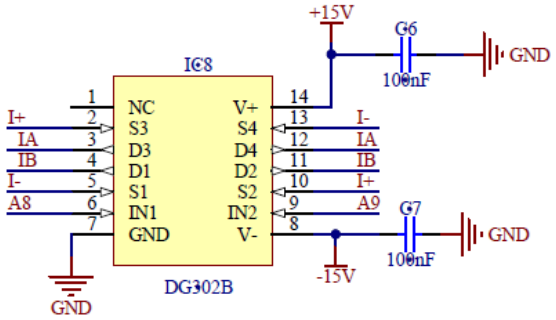
D- Sub 25p, oben F / unten F / Güteklass

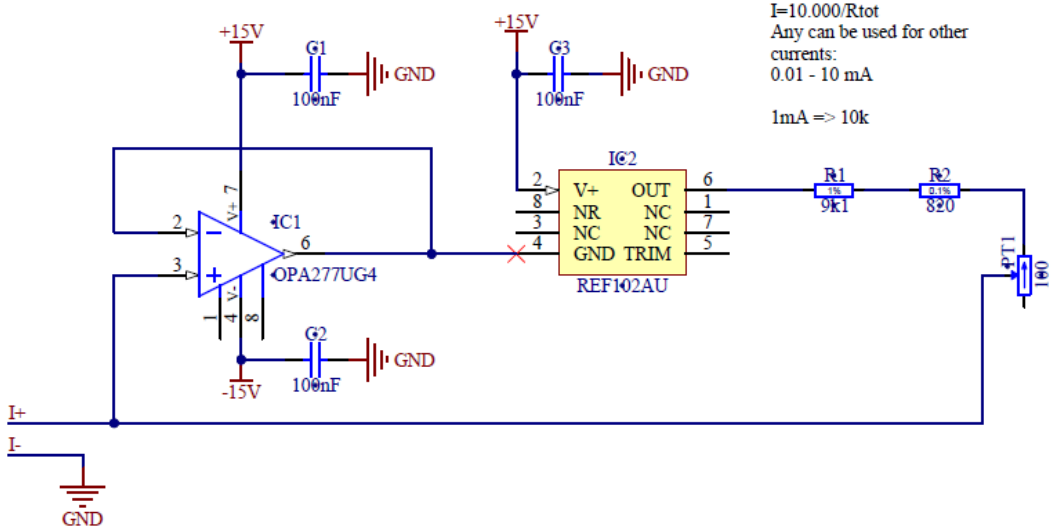
Manufacturer:	FCT Electronic
Fabricant prod no.:	FDT-25SG2M
Série:	FD

Voir la série

Current source circuit

From Texas Instruments
http://www.ti.com/lit/an/sbva001/sbva001.pdf





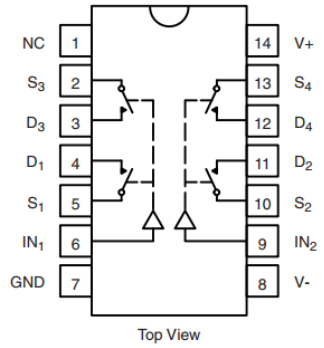
Current source polarity reversing using the circuit DG302B

Vishay Siliconix

FUNCTIONAL BLOCK DIAGRAM

DG302B

Plastic DIP



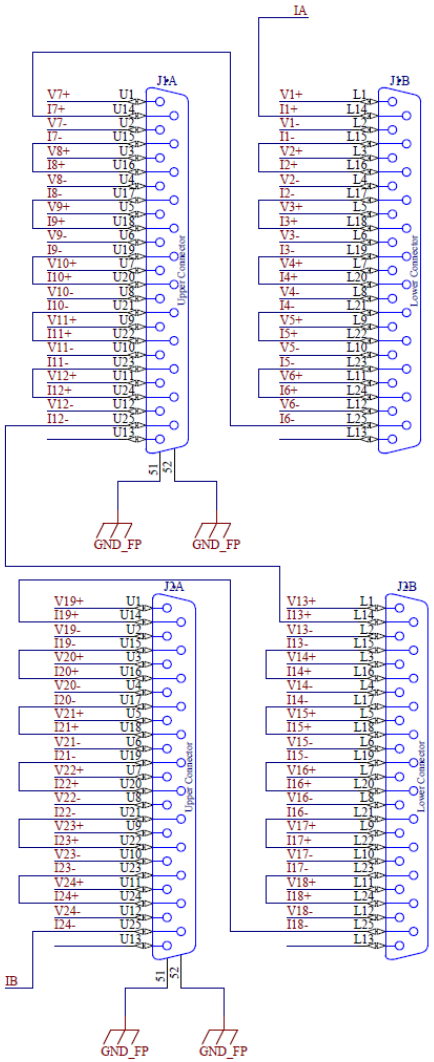
Top View

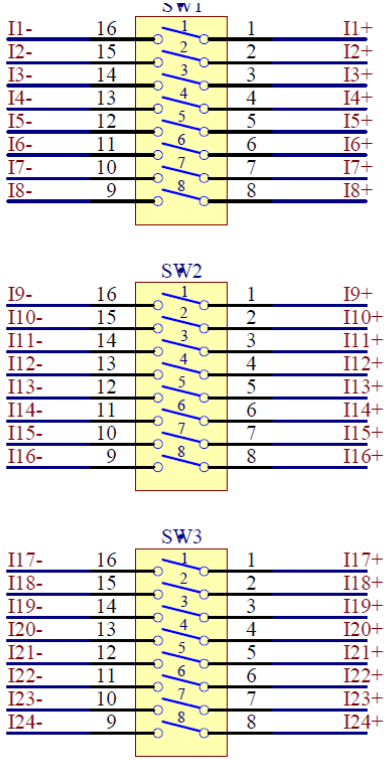
TRUTH TABLE	
Logic	**Switch**
0	OFF
1	ON

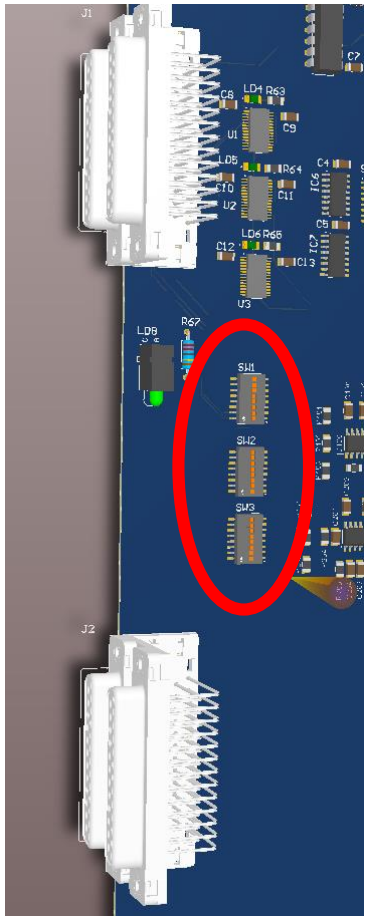
Logic "0" ≤ 0.8 V
Logic "1" ≥ 4 V

By-passing unused PT100 channels

As the current source is connected in serial in case of an unused PT100 sensor the current source for that channel has to by bypassed by means of switch

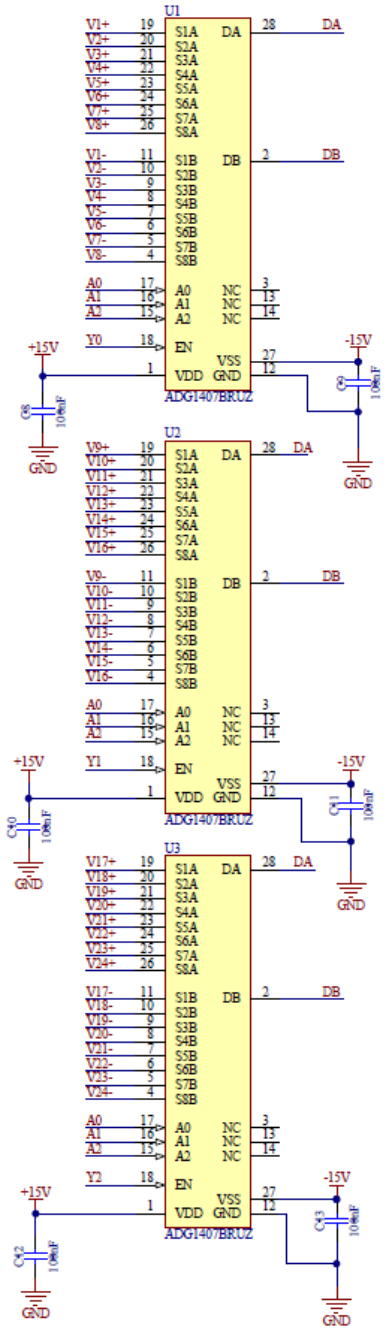






Multiplexer circuit
3 multiplexers ADG1407

Connected in Cascade



FEATURES

- 9.5 Ω on resistance at 25°C
- Up to 300 mA of continuous current
- Fully specified at ±15 V/+12 V/±5 V
- 3 V logic-compatible inputs
- Rail-to-rail operation
- Break-before-make switching action
- 28-lead TSSOP and 32-lead, 5 mm × 5 mm LFCSP

APPLICATIONS

- Medical equipment
- Audio and video routing
- Automatic test equipment
- Data acquisition systems
- Battery-powered systems
- Sample-and-hold systems
- Communication systems

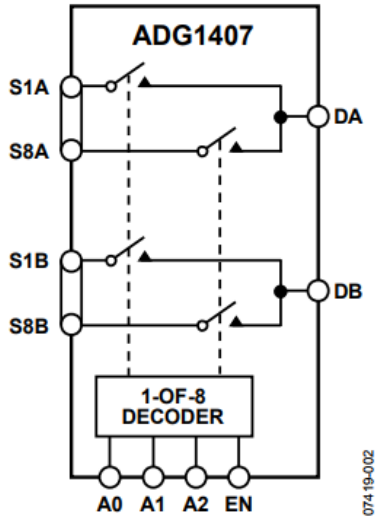
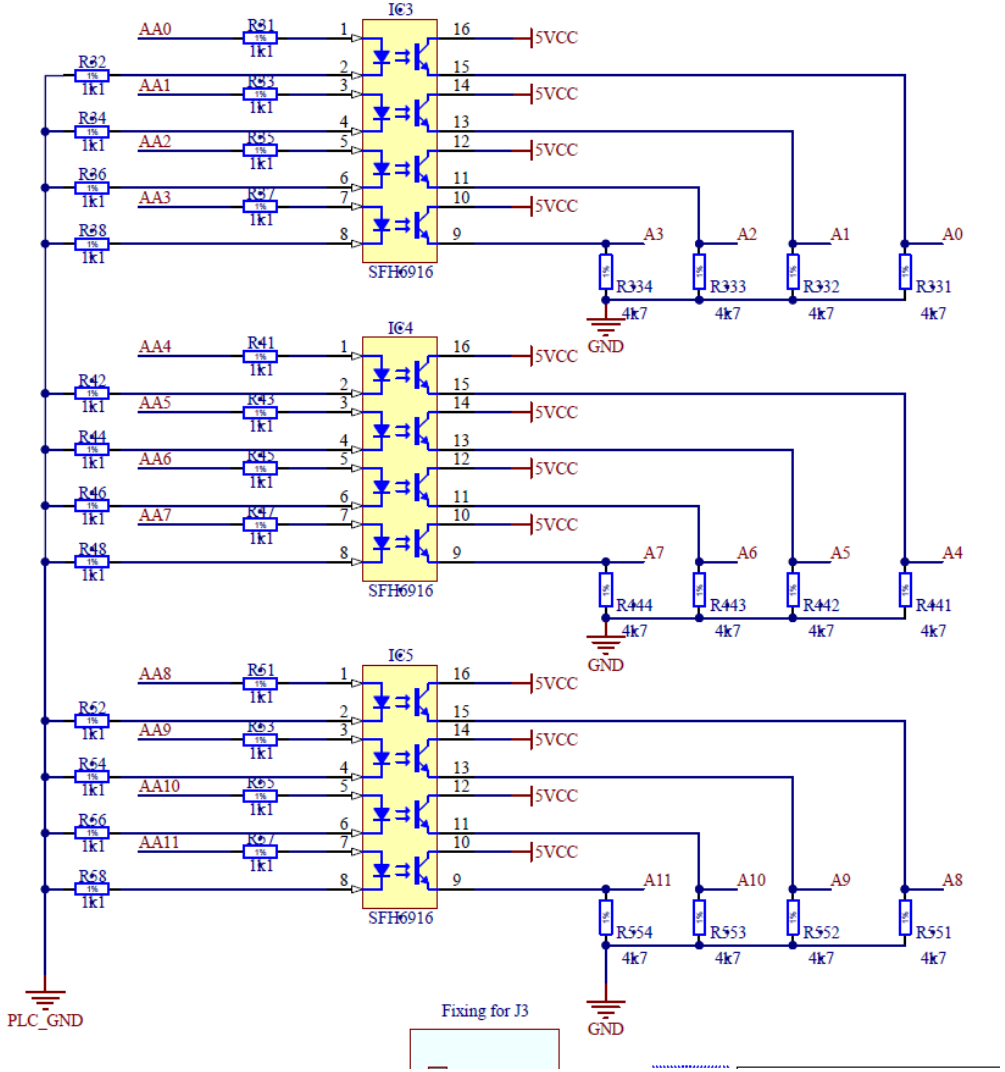


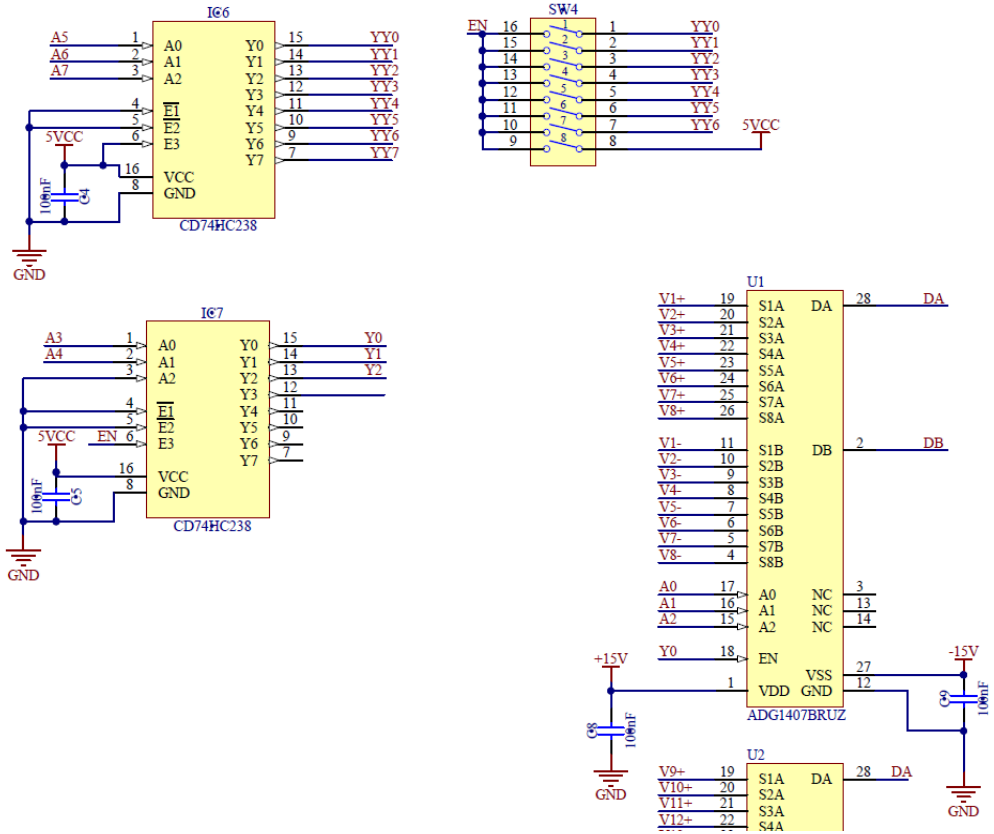
Figure 2.

Multiplexer Decoding Circuit

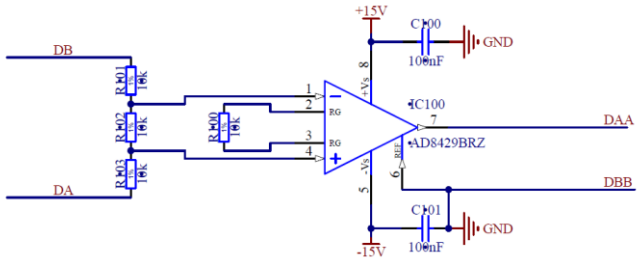


Digital output optocoupled from ADC-controller

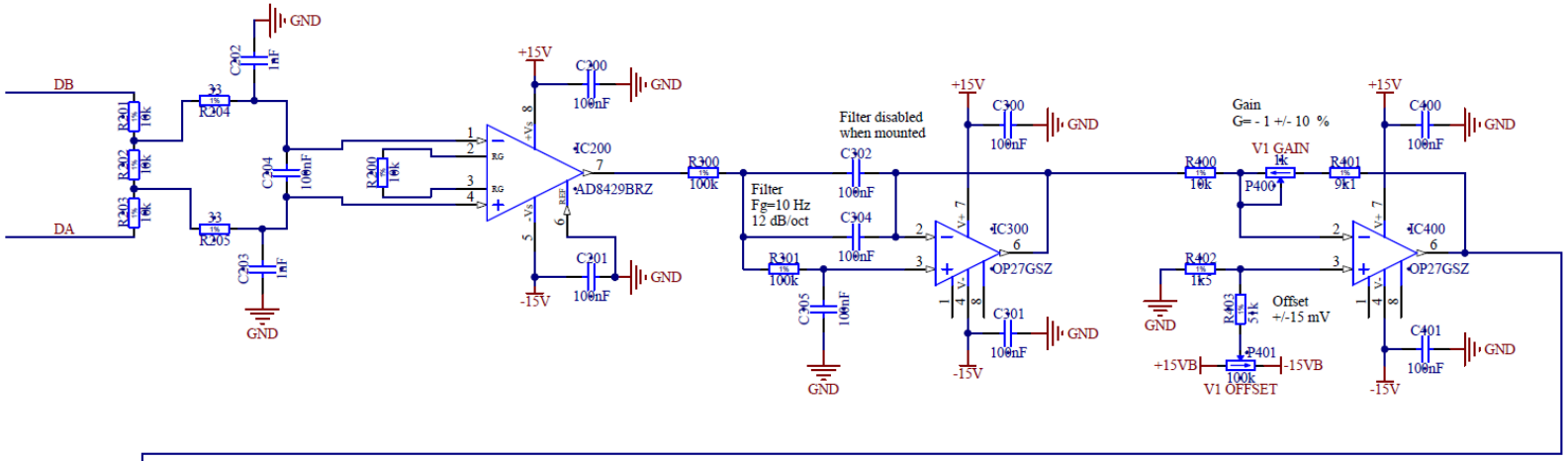
3 bits A0, A1, A2 for addressing channel
2 bits for addressing multiplexer A3,A4
3 bits A5, A6, A7 for board addressing

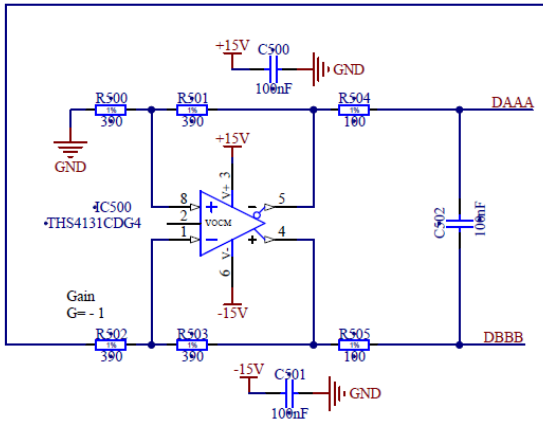


Amplification Circuit (Optional)



Option 1 just
Direct amplification





Option 2 – Input filtering
- Output filtering
- Gain + Offset adjustment
- Differential signal output

FEATURES

Low noise
- 1 nV/√Hz input noise
- 45 nV/√Hz output noise

High accuracy dc performance (AD8429BRZ)
- 90 dB CMRR minimum (G = 1)
- 50 µV maximum input offset voltage
- 0.02% maximum gain accuracy (G = 1)

Excellent ac specifications
- 80 dB CMRR to 5 kHz (G = 1)
- 15 MHz bandwidth (G = 1)
- 1.2 MHz bandwidth (G = 100)
- 22 V/µs slew rate
- THD: −130 dBc (1 kHz, G = 1)

Versatile
- ±4 V to ±18 V dual supply
- Gain set with a single resistor (G = 1 to 10,000)

Temperature range for specified performance
- −40°C to +125°C

APPLICATIONS

Medical instrumentation
Precision data acquisition
Microphone preamplification
Vibration analysis

PIN CONNECTION DIAGRAM

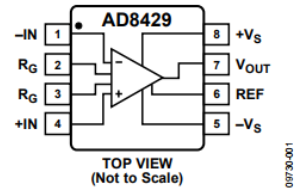


Figure 1.

where:

$$G = 1 + \frac{6\,\text{k}\Omega}{R_G}$$