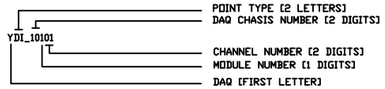
ELECTRICAL DRAWING INDEX

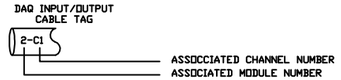
DWG NO.	DRAWING DESCRIPTION
PL00093-11-01	ELECTRICAL DRAWING INDEX
PL00093-11-02	TRAILER ELECTRICAL EQUIPMENT LAYOUT
PL00093-11-03	SYSTEM SCHEMATIC
PL00093-11-04	ELECTRICAL POWER DISTRIBUTION
PL00093-11-05	EXPLOSION-PROOF ENCLOSURE LAYOUT
PL00093-11-06	DAQ SYSTEM & NETWORK LAYOUT
PL00093-11-07	DAQ POINTS LIST
PL00093-11-08	DAQ MODULE 1 DI/DO WIRING DETAILS
PL00093-11-09	DAQ MODULE 2 AI WIRING DETAILS
PL00093-11-10	DAQ MODULE 3 TT WIRING DETAILS
PL00093-11-11	DAQ MODULE 4 DO WIRING DETAILS
PL00093-11-12	FIRE DETECTION WIRING DETAILS
PL00093-11-13	GAS DETECTION WIRING DETAILS
PL00093-11-14	EMERGENCY SHUTDOWN (ESD) CIRCUIT WIRING DETAILS
PL00093-11-15	PNEUMATIC CONTROL SYSTEM SCHEMATIC
PL00093-11-16	INTRINSIC SAFETY DEVICE SCHEDULE
PL00093-11-17	BILL OF ELECTRICAL MATERIALS

DRAWING NOTES

1) DAQ POINT ID



2) DAQ CABLE TAG



3) ACRONYMS
DAQ - DATA ACQUISITION SYSTEM
IrDA - INFRARED DATA ASSOCIATION
HMI - HUMAN-MACHINE INTERFACE

4) INTRINSIC SAFETY

Hazardous (Classified) Location
Class 1, Division 2, Group B

INTRINSICALLY SAFE APPARATUS WITH ENTITY PARAMETERS

Vmax (or Ui) ≥ Voc (or Uo)
Imax (or Ii) ≥ Isc (or Io)
Ci + Ccable ≤ Ca (or Co)
Li + Lcable ≤ La (or Lo)
Lcable/Rcable verification (See note 5)

OR

SIMPLE APPARATUS

Notes to Intrinsic Safety Wiring:
1. The maximum unclassified location voltage, Um, is 250 V ac/dc.
2. Barrier ground shall be connected to a grounding electrode ANSI/NFPA 70, Articles 504. The resistance of the ground path must be less than 1 ohm. Barrier grounding is established on the standard 35mm Din Rail bonded to the ground electrode (AWG#10).
3. Barriers shall not be connected any device which uses or generates internally any voltage in excess of 250Vrms or DC unless the device has been determined to adequately isolate the voltage from the barrier.
4. The installation must be in accordance with the Class 1, Division 2 wiring methods of National Electrical Code, NFPA 70, Articles 504 and 505, and ANSI/ISA-RP12.06.01, Canadian Electrical Code C22.1 or in accordance with the authority having the jurisdiction.
5. Simple Apparatus: An electrical component or combination of components of simple construction with well defined electrical parameters that does not generate more than 1.5 volts, 100 milliamps, and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts.
6. Li may be greater than La and the cable length restrictions due to cable inductance (Lcable) can be ignored if both of the following conditions are met:
   La/Ra (or Lo/Ro) ≥ Li/Ri
   La/Ra (or Lo/Ro) ≥ Lcable/Rcable

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0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
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2	ISSUED FOR MATERIAL PROCUREMENT	01MAY2015	BW	GM	GM
3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742
DRAWING NUMBER: PL-00742-11-01
SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE
DRAWING TITLE: ELECTRICAL DRAWING INDEX

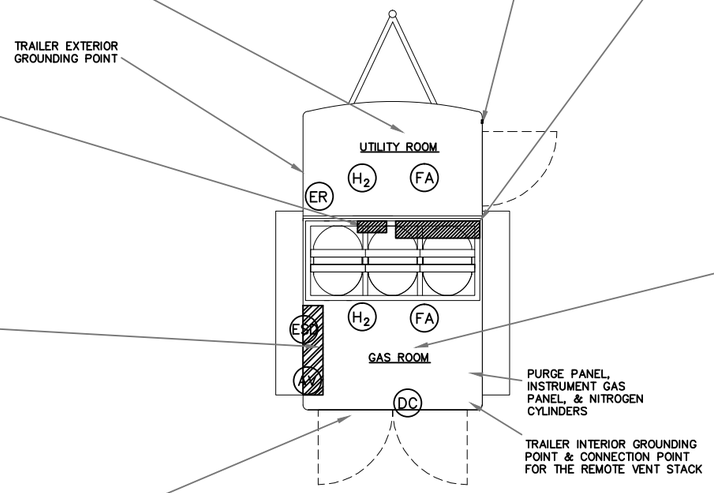
UTILITY ROOM
YDI10103 – UTILITY RM HYDROGEN PROBE FAILED ALARM
YAI10205 – UTILITY RM GAS LEVEL (%LEL)
FIRE HEAT DETECTOR TO ESD CIRCUIT (SEE DWG#PL–00742–11–13) AND GAS ALARM TO ESD CIRCUIT (SEE DWG#PL–00742–11–13 FOR DETAILS

LOCKABLE BOX FOR SOLENOID BYPASS VALVES (ABOVE)
MANUAL BYPASS VALVES (TYPICAL OF 5)
INTRINSIC SAFETY J/B #1 (BELOW)
TERMINAL STRIP TS–2

OPERATOR CONTROL PANEL
HUMAN MACHINE INTERFACE (HMI)
YDO10402 – AUDIBLE ALARM
YDO10401 – VISUAL STROBE ALARM
YDI10110 – AV ALARM SILENCE BUTTON
NOZZLE RECEPTACLE
IrDA TRANSMITTER
EMERGENCY SHUTDOWN PUSH BUTTON
(SEE DWG# PL00742–11–03 FOR DETAILED LAYOUT) & ESD BUTTON TO ESD CIRCUIT (SEE DWG#PL–00742–11–14)

PASS–THRU FOR ELECTRICAL POWER
120VAC 15A ELECTRICAL POWER EXTENSION CORD (80 FT)

TRAILER EXTERIOR GROUNDING POINT



YTI 10310 – AMBIENT TEMPERATURE SENSOR

TRAILER PLAN VIEW

EXPLOSION–PROOF ENCLOSURE
DAQ20103– cDAQ–9132 CHASSIS CPU
DAQ20104 – 24VDC 10AMP POWER SUPPLY CHASSIS 1
IOM20105 – MODULE 1: SINKING DIGITAL INPUT/SOURCING DIGITAL OUTPUT 32 CHANNELS
IOM20106 – MODULE 2: ANALOG CURRENT INPUT 16 CHANNELS
IOM20107 – MODULE 3: THERMOCOUPLE INPUT 16 CHANNELS
IOM20108 – MODULE 4: SOURCING DIGITAL OUTPUT 8 CHANNELS
YDO10400 – ESD cDAQ SHUTDOWN COMMAND
YDI10100 – ESD CIRCUIT MONITORING
YDI10101 – INSTRUMENT GAS PRESSURE SWITCH
YDO10101 – HYDROGEN RECEPTACLE: Electric Solenoid Valve to Pneumatic–Actuated Valve
YDO10102 – HYDROGEN TANK #1: Electric Solenoid Valve to Pneumatic–Actuated Valve
YDO10103 – HYDROGEN TANK #2: Electric Solenoid Valve to Pneumatic–Actuated Valve
YDO10104 – HYDROGEN TANK #3: Electric Solenoid Valve to Pneumatic–Actuated Valve
YDO10105 – GAS VENT LINE: Electric Solenoid Valve to Pneumatic–Actuated Valve
IrDA SIGNAL GENERATOR
RELAYS – R1, R2, R3, R4, & R–5
POWER SUPPLY – PS1 & PS2
TERMINAL STRIP – TS1 & TS2
FUSE BLOCKS – F1 to F12
INSTRUMENT GAS PRESSURE SWITCH – AS1
MAIN GAS SOLENOID VALVE – MAS1
SOLENOID VALVES – AS1 TO AS5
INTRINSIC BARRIERS – ISB1 to ISB21
(SEE DWG# PL–00742–11–05 FOR DETAILED LAYOUT)

GAS ROOM
YDI10104 – RECEPTACLE PNEUMATIC–ACTUATED VALVE END SWITCH
YDI10105 – HYDROGEN TANK #1 PNEUMATIC–ACTUATED VALVE END SWITCH
YDI10106 – HYDROGEN TANK #2 PNEUMATIC–ACTUATED VALVE END SWITCH
YDI10107 – HYDROGEN TANK #3 PNEUMATIC–ACTUATED VALVE END SWITCH
YDI10108 – PURGE VENT PNEUMATIC–ACTUATED VALVE END SWITCH
YAI10200 – RECEPTACLE – INLET PRESSURE
YAI10201 – HYDROGEN TANK #1 – LINE PRESSURE
YAI10202 – HYDROGEN TANK #2 – LINE PRESSURE
YAI10203 – HYDROGEN TANK #3 – LINE PRESSURE
YTI10300 – HYDROGEN TANK #1 – TANK INTERNAL TEMPERATURE A
YTI10301 – HYDROGEN TANK #1 – TANK INTERNAL TEMPERATURE B
YTI10302 – HYDROGEN TANK #1 – INLET GAS TEMPERATURE
YTI10303 – HYDROGEN TANK #2 – TANK INTERNAL TEMPERATURE A
YTI10304 – HYDROGEN TANK #2 – TANK INTERNAL TEMPERATURE B
YTI10305 – HYDROGEN TANK #2 – INLET GAS TEMPERATURE
YTI10306 – HYDROGEN TANK #3 – TANK INTERNAL TEMPERATURE A
YTI10307 – HYDROGEN TANK #3 – TANK INTERNAL TEMPERATURE B
YTI10308 – HYDROGEN TANK #3 – INLET GAS TEMPERATURE
YTI10309 – RECEPTACLE INLET GAS TEMPERATURE
YDI10109 – TRAILER GAS ROOM DOOR MONITOR
YDI10102 – GAS RM HYDROGEN PROBE FAILED ALARM
YAI10204 – GAS RM HYDROGEN LEVEL (%LEL)
HARDWIRED – FIRE HEAT DETECTOR TO ESD CIRCUIT (SEE DWG#PL–00742–11–13) AND GAS ALARM TO ESD CIRCUIT (SEE DWG#PL–00742–11–13 FOR DETAILS

LEGEND

- (FA) FIRE ALARM HEAT DETECTOR
- (H_2) HYDROGEN GAS DETECTION PROBE
- (ESD) EMERGENCY SHUTDOWN PUSH BUTTON
- (ER) ETHERNET RECEPTACLE (LAN)
- (AV) AUDIBLE/VISUAL ALARM
- (DC) DOOR CONTACT

NOTE TO POWER UP THE SYSTEM
THERE IS NO SWITCH IN THE TRAILER TO TURN ON/OFF THE SYSTEM. WHEN THE EXTENSION CORD IS PLUGGED INTO ELECTRICAL POWER SOURCE, THE SYSTEM WILL START UP AUTOMATICALLY INCLUDING THE cDAQ, HMI, HYDROGEN GAS DETECTORS, LED LIGHTS IN THE GAS ROOM & UTILITY ROOM, & AUDIBLE/VISUAL ALARM. THE cDAQ SYSTEM SHALL BE SHUTDOWN PROPERLY BEFORE DISCONNECTING THE EXTENSION CORD FROM THE POWER SOURCE.

REVISIONS

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3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS–BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

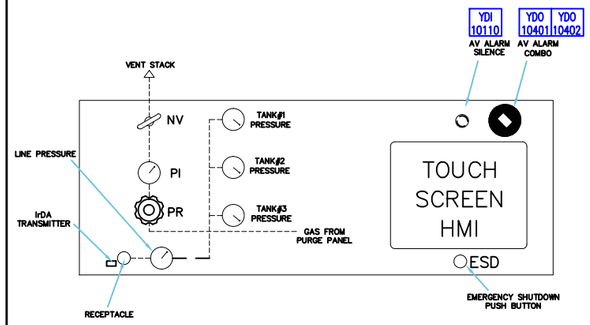
REFERENCE DRAWINGS/DOCUMENTS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

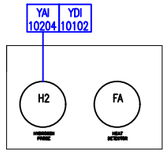
PROJECT NUMBER: PL–00742
DRAWING NUMBER: PL–00742–11–02
SHEET: 1 OF 1

Powertech

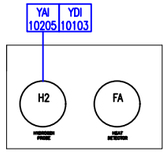
PROJECT TITLE: HYDROGEN STATION TESTING DEVICE
DRAWING TITLE: TRAILER ELECTRICAL EQUIPMENT LAYOUT



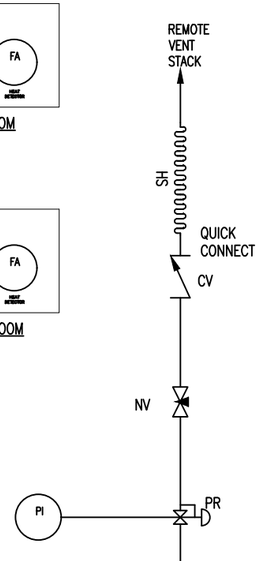
OPERATOR CONTROL PANEL



GAS ROOM



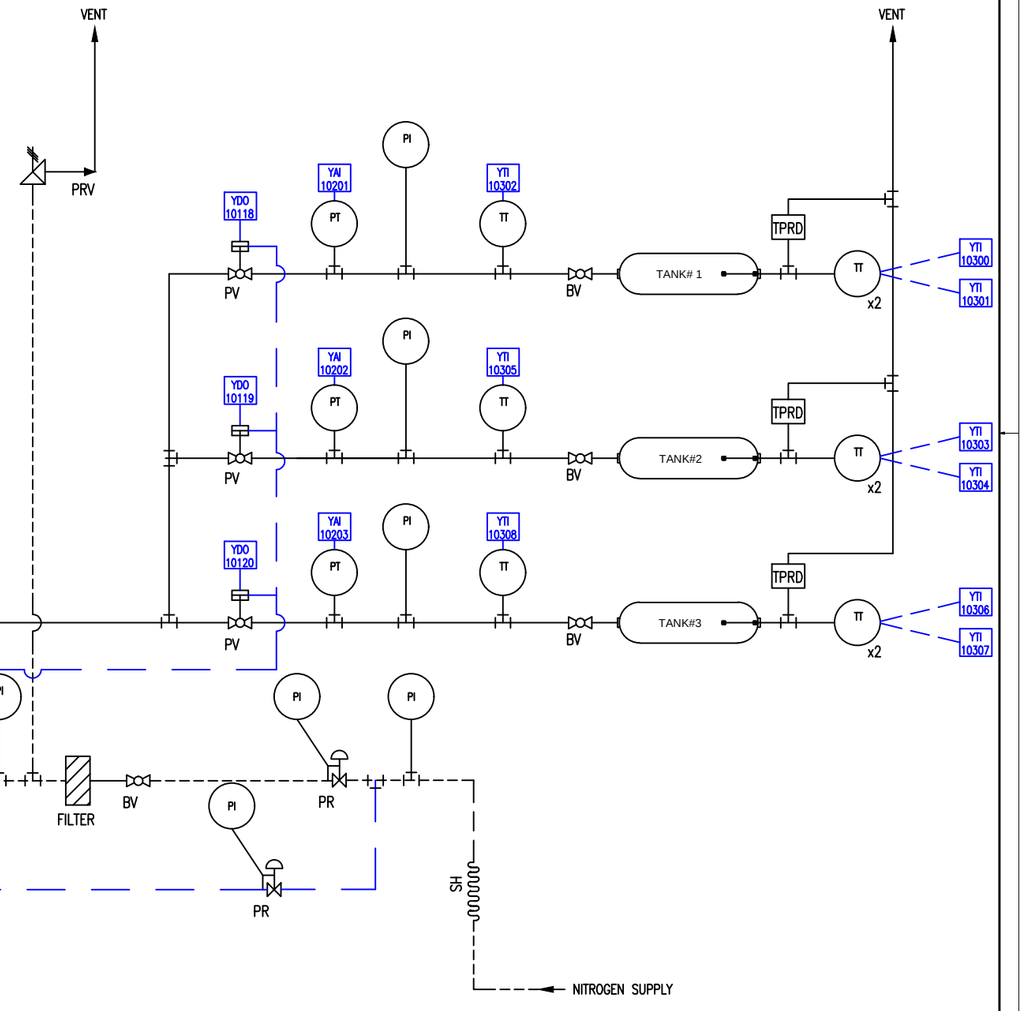
UTILITY ROOM



LEGEND
H2 – HYDROGEN SENSOR
FA – HEAT DETECTOR
TT – THERMOCOUPLE
PT – PRESSURE TRANSDUCER
ESD – EMERGENCY SHUTDOWN
NV – NEEDLE VALVE
PR – PRESSURE REGULATOR
CV – CHECK VALVE
PV – PNEUMATIC–ACTUATED VALVE
BV – BALL VALVE
HS – HOSE
PI – PRESSURE INDICATOR
TPRD – TEMPERATURE PRESSURE RELIEF DEVICE
PRV – PRESSURE RELIEF DEVICE

$$$ ####
I/O POINT ADDRESS

$$ ##
DEVICE IDENTIFIER



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REVISIONS

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REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL–00742

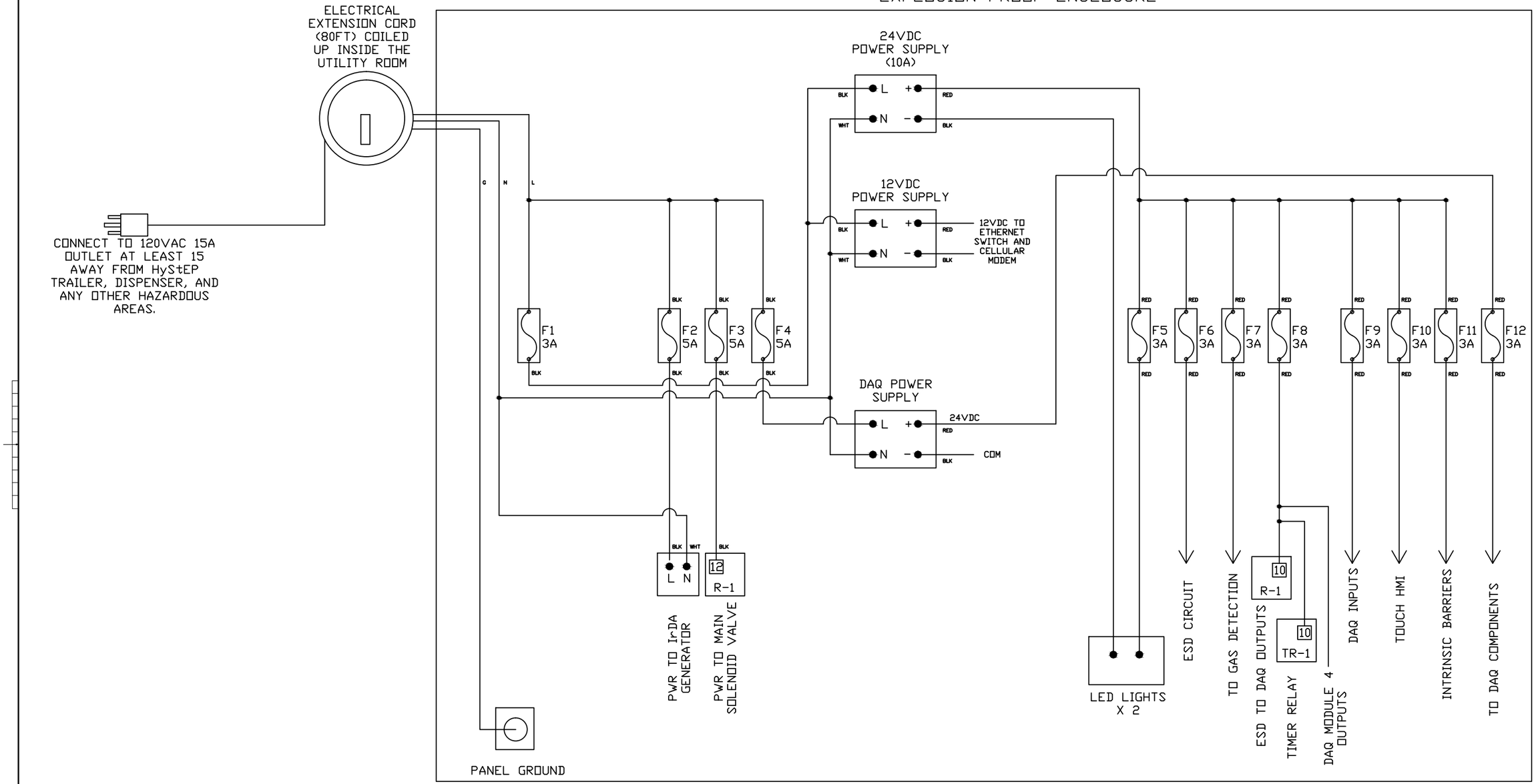
DRAWING NUMBER: PL–00742–11–03

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: SYSTEM SCHEMATIC



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3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	SIERRA WIRELESS AIRLINK GATEWAY ADDED	14MAY2015	BW	GM	GM
5	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

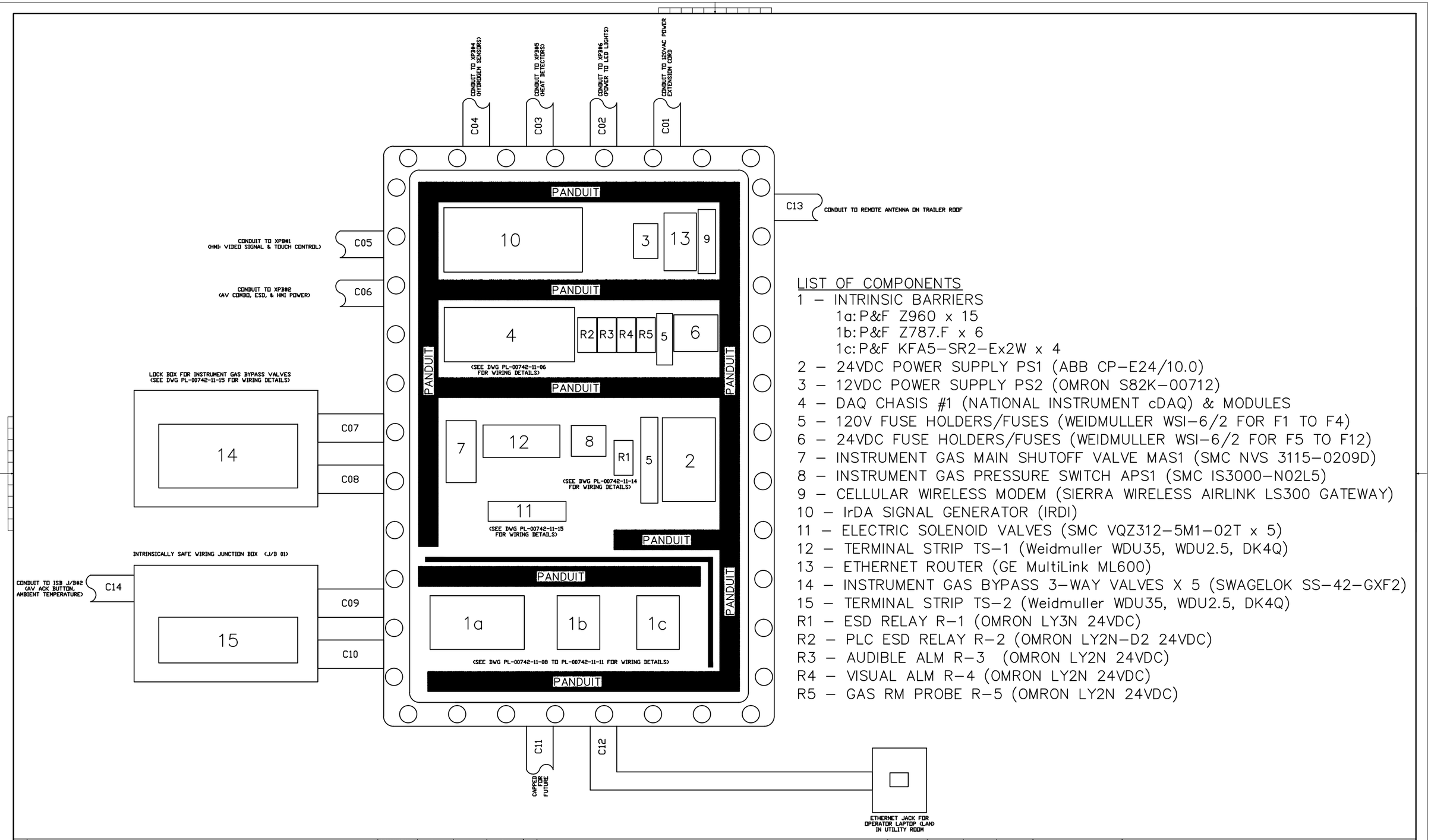
DRAWING NUMBER: PL-00742-11-04

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: ELECTRICAL POWER DISTRIBUTION



LIST OF COMPONENTS

1 – INTRINSIC BARRIERS
  1a: P&F Z960 x 15
  1b: P&F Z787.F x 6
  1c: P&F KFA5–SR2–Ex2W x 4
2 – 24VDC POWER SUPPLY PS1 (ABB CP–E24/10.0)
3 – 12VDC POWER SUPPLY PS2 (OMRON S82K–00712)
4 – DAQ CHASIS #1 (NATIONAL INSTRUMENT cDAQ) & MODULES
5 – 120V FUSE HOLDERS/FUSES (WEIDMULLER WSI–6/2 FOR F1 TO F4)
6 – 24VDC FUSE HOLDERS/FUSES (WEIDMULLER WSI–6/2 FOR F5 TO F12)
7 – INSTRUMENT GAS MAIN SHUTOFF VALVE MAS1 (SMC NVS 3115–0209D)
8 – INSTRUMENT GAS PRESSURE SWITCH APS1 (SMC IS3000–N02L5)
9 – CELLULAR WIRELESS MODEM (SIERRA WIRELESS AIRLINK LS300 GATEWAY)
10 – IrDA SIGNAL GENERATOR (IRDI)
11 – ELECTRIC SOLENOID VALVES (SMC VQZ312–5M1–02T x 5)
12 – TERMINAL STRIP TS–1 (Weidmuller WDU35, WDU2.5, DK4Q)
13 – ETHERNET ROUTER (GE MultiLink ML600)
14 – INSTRUMENT GAS BYPASS 3–WAY VALVES X 5 (SWAGELOK SS–42–GXF2)
15 – TERMINAL STRIP TS–2 (Weidmuller WDU35, WDU2.5, DK4Q)
R1 – ESD RELAY R–1 (OMRON LY3N 24VDC)
R2 – PLC ESD RELAY R–2 (OMRON LY2N–D2 24VDC)
R3 – AUDIBLE ALM R–3 (OMRON LY2N 24VDC)
R4 – VISUAL ALM R–4 (OMRON LY2N 24VDC)
R5 – GAS RM PROBE R–5 (OMRON LY2N 24VDC)

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3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	SIERRA WIRELESS AIRLINK GATEWAY ADDED	14MAY2015	BW	GM	GM
5	AS–BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REFERENCE DRAWINGS/DOCUMENTS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

PROJECT NUMBER: PL–00742

DRAWING NUMBER: PL–00742–11–05

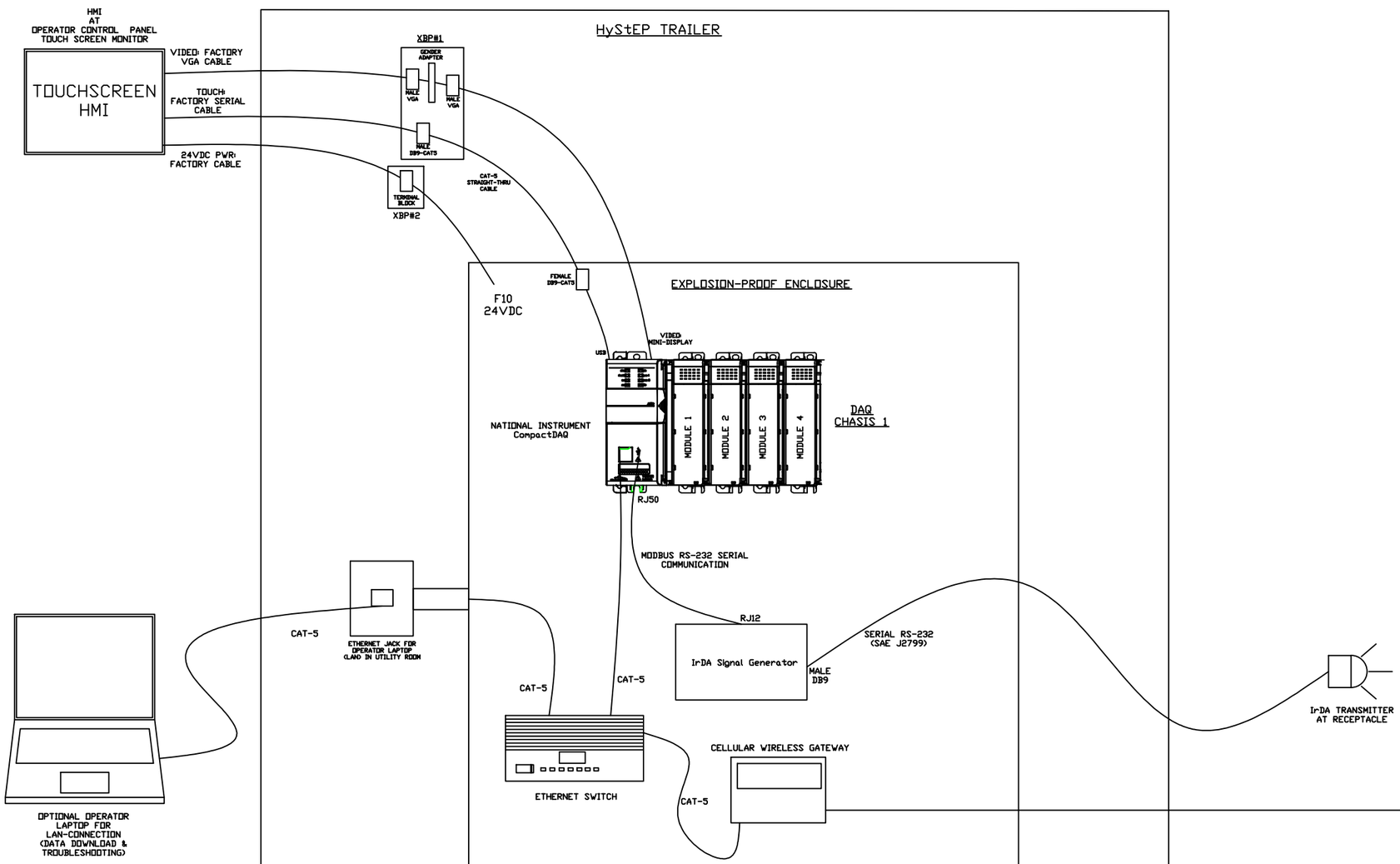
SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: EXPLOSION–PROOF ENCLOSURE LAYOUT

Part ID		Description	Manufacturer	Part Number
DAQ	20103	DAQ Chassis - CPU	National Instrument	NI 9132
DAQ	20104	DAQ Chassis - Power Supply - 120VAC-24VDC, 5A	National Instrument	NI PS-15
IOM	20105	DAQ Module 1 - 32 Channel, Sinking Digital Input/Sourcing Digital Output Module	National Instrument	NI 9375
IOM	20106	DAQ Module 2 - 16 Channel Analog Current Input Module	National Instrument	NI 9208
IOM	20107	DAQ Module 3 - 16 Channel Thermocouple/Mv Input Module	National Instrument	NI 9213
IOM	20108	DAQ Module 4 - 8 Channel, Sourcing Digital Output Module	National Instrument	NI 9472



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4	SIERRA WIRELESS AIRLINK GATEWAY ADDED	14MAY2015	BW	GM	GM
5	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

DRAWING NUMBER: PL-00742-11-06

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: DAQ SYSTEM & NETWORK LAYOUT

Point ID		Point Description	Point Type	I/O Signal / Measurement Range	Point Label	END DEVICE Manufacturer	Part Number	Part Descriptionr	Certification	Part ID	I.S. Barrier
YDI	10100	Emergency Shutdown Circuit Monitoring	24VDC Sinking Digital Input	N.C. dry contact / open during normal operation	ESD_MON	Omron	LY3N	24VDC Relay DPDT, 10A 240VAC	CSA, CE, RU	R1	n/a
YDI	10101	Instrument Gas Pressure Switch	24VDC Sinking Digital Input	N.C. dry contact / open during normal operation	AIR_MON	SMC	IS3000-N02L5	DC24V4A, 0.1-0.7 MPa	CE	AS1	n/a
YDI	10102	Gas Room - Hydrogen Detector Failed	24VDC Sinking Digital Input	N.O. dry contact / Close during normal operation	GAS_H2	RKI Instruments INC	65-2641RK/H2	Hydrogen %LEL, 4-20mA, 2 Programmable Alarm Relays & Fail Relay, Explosion-Proof, Direct Digital Readout.	UL	HS1	n/a
YDI	10103	Utility Room - Hydrogen Detector Failed	24VDC Sinking Digital Input	N.O. dry contact / Close during normal operation	UTI_H2	RKI Instruments INC	65-2641RK/H2	Hydrogen %LEL, 4-20mA, 2 Programmable Alarm Relays & Fail Relay, Explosion-Proof, Direct Digital Readout.	UL	HS2	n/a
YDI	10104	Hydrogen Receptacle - Pneumatic-Actuated Valve End Switch	24VDC Sinking Digital Input	N.O. dry contact / Contact close when valve close	RECEP_AVS	Philmore (LKG INDUSTRIES)	30-2040	Mini Snap Action Switch with Long Lever, SPDT, 0.5A -125VDC	RU	AV5	P&F KFA5-SR2-EX2W
YDI	10105	Hydrogen Tank #1 - Pneumatic-Actuated Valve End Switch	24VDC Sinking Digital Input	N.O. dry contact / Contact close when valve close	TNK1_AVS	Philmore (LKG INDUSTRIES)	30-2040	Mini Snap Action Switch with Long Lever, SPDT, 0.5A -125VDC	RU	AV1	P&F KFA5-SR2-EX2W
YDI	10106	Hydrogen Tank #2 - Pneumatic-Actuated Valve End Switch	24VDC Sinking Digital Input	N.O. dry contact / Contact close when valve close	TNK2_AVS	Philmore (LKG INDUSTRIES)	30-2040	Mini Snap Action Switch with Long Lever, SPDT, 0.5A -125VDC	RU	AV2	P&F KFA5-SR2-EX2W
YDI	10107	Hydrogen Tank #3 - Pneumatic-Actuated Valve End Switch	24VDC Sinking Digital Input	N.O. dry contact / Contact close when valve close	TNK3_AVS	Philmore (LKG INDUSTRIES)	30-2040	Mini Snap Action Switch with Long Lever, SPDT, 0.5A -125VDC	RU	AV3	P&F KFA5-SR2-EX2W
YDI	10108	Vent Line - Pneumatic-Actuated Valve End Switch	24VDC Sinking Digital Input	N.O. dry contact / Contact close when valve close	VENT_AVS	Philmore (LKG INDUSTRIES)	30-2040	Mini Snap Action Switch with Long Lever, SPDT, 0.5A -125VDC	RU	AV4	P&F KFA5-SR2-EX2W
YDI	10109	Trailer Gas Room Door Monitor	24VDC Sinking Digital Input	N.O. dry contact / Contact close when door close	DOOR_MON	Omron	D4A-1101N	Mechanical Position Switch with Level, DPDT	UL	DS	P&F KFA5-SR2-EX2W
YDI	10110	Trailer Audible/Visual Alarm Momentary Push Button (Silence)	24VDC Sinking Digital Input	N.O. dry contact / Contact close when pressed	AV_ACK	ABB	CP1-10G-10	Momentary push button (N.O.), SPST, IEC60947-5-1	UL	AA	P&F KFD2-SR2-EX2W
YDI	10111	spare	24VDC Sinking Digital Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDI	10112	spare	24VDC Sinking Digital Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDI	10113	spare	24VDC Sinking Digital Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDI	10114	spare	24VDC Sinking Digital Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDI	10115	spare	24VDC Sinking Digital Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10100	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10101	Hydrogen Receptacle - Electric Solenoid Valve to Pneumatic-Actuated Valve	24VDC Sourcing Digital Output	24VDC to energize electric solenoid valve	RECEP_AV	SMC	VQZ312-5M1-02T	24VDC solenoid Open/Close Valve	n/a	SV1	n/a
YDO	10102	Hydrogen Tank #1 - Electric Solenoid Valve to Pneumatic-Actuated Valve	24VDC Sourcing Digital Output	24VDC to energize electric solenoid valve	TNK1_AV	SMC	VQZ312-5M1-02T	24VDC solenoid Open/Close Valve	n/a	SV2	n/a
YDO	10103	Hydrogen Tank #2 - Electric Solenoid Valve to Pneumatic-Actuated Valve	24VDC Sourcing Digital Output	24VDC to energize electric solenoid valve	TNK2_AV	SMC	VQZ312-5M1-02T	24VDC solenoid Open/Close Valve	n/a	SV3	n/a
YDO	10104	Hydrogen Tank #3 - Electric Solenoid Valve to Pneumatic-Actuated Valve	24VDC Sourcing Digital Output	24VDC to energize electric solenoid valve	TNK3_AV	SMC	VQZ312-5M1-02T	24VDC solenoid Open/Close Valve	n/a	SV4	n/a
YDO	10105	Gas Vent Line - Electric Solenoid Valve to Pneumatic-Actuated Valve	24VDC Sourcing Digital Output	24VDC to energize electric solenoid valve	VENT_AV	SMC	VQZ312-5M1-02T	24VDC solenoid Open/Close Valve	n/a	SV5	n/a
YDO	10106	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10107	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10108	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10109	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10110	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10111	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10112	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10113	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10114	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10115	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

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0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
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2	ISSUED FOR MATERIAL PROCUREMENT	01MAY2015	BW	GM	GM
3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

DRAWING NUMBER: PL-00742-11-07

SHEET: 1 OF 2

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: INPUT/OUTPUT POINTS LIST

Point ID		Point Description	Point Type	I/O Signal / Measurement Range	END DEVICE						
					Point Label	Manufacturer	Part Number	Part Descriptionr	Certification	Part ID	I.S. Barrier
YAI	10200	Receptacle Inlet Pressure	4-20mA Analog Input	4-20mA signal / 0 - 15,000 psi	P_recep	Stellar Technologies	GT2250-10000G-215	24VDC, 4-20mA, protected by Intrinsically Safe Circuit	UL	PT4	P&F Z787.F
YAI	10201	Hydrogen Tank #1 - Line Pressure	4-20mA Analog Input	4-20mA signal / 0 - 15,000 psi	P_tank1	Stellar Technologies	GT2250-10000G-215	24VDC, 4-20mA, protected by Intrinsically Safe Circuit	UL	PT1	P&F Z787.F
YAI	10202	Hydrogen Tank #2 - Line Pressure	4-20mA Analog Input	4-20mA signal / 0 - 15,000 psi	P_tank2	Stellar Technologies	GT2250-10000G-215	24VDC, 4-20mA, protected by Intrinsically Safe Circuit	UL	PT2	P&F Z787.F
YAI	10203	Hydrogen Tank #3 - Line Pressure	4-20mA Analog Input	4-20mA signal / 0 - 15,000 psi	P_tank3	Stellar Technologies	GT2250-10000G-215	24VDC, 4-20mA, protected by Intrinsically Safe Circuit	UL	PT3	P&F Z787.F
YAI	10204	Gas Room - Hydrogen Level [%LEL]	4-20mA Analog Input	4-20mA signal / 0 - 100 % LEL	H2_conc1	RKI Instruments INC	65-2641RK/H2	Hydrogen %LEL, 4-20mA, 2 Programmable Alarm Relays & Fail Relay, Explosion-Proof, Direct Digital Readout.	UL	HS1	Explosion-Proof Enc
YAI	10205	Utility Room - Hydrogen Level [%LEL]	4-20mA Analog Input	4-20mA signal / 0 - 100 % LEL	H2_conc2	RKI Instruments INC	65-2641RK/H2	Hydrogen %LEL, 4-20mA, 2 Programmable Alarm Relays & Fail Relay, Explosion-Proof, Direct Digital Readout.	UL	HS2	Explosion-Proof Enc
YAI	10206	Spare 4-20mA Input: Terminated at ISB J/B 01 & prewired with IS Barrier.	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P&F Z787.F
YAI	10207	Spare 4-20mA Input: Terminated at ISB J/B 01 & prewired with IS Barrier.	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P&F Z787.F
YAI	10208	spare	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YAI	10209	spare	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YAI	10210	spare	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YAI	10211	spare	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YAI	10212	spare	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YAI	10213	spare	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YAI	10214	spare	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YAI	10215	spare	4-20mA Analog Input	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YTI	10300	Hydrogen Tank #1 - Tank Internal Temperature A	Type T Thermocouple	-328 to 662°F	T_tank1a	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, 18" long with sensing element at tip and 12" back from tip. Protected by Intrinsically Safe Circuit	UL	TT1a	P&F Z960
YTI	10301	Hydrogen Tank #1 - Tank Internal Temperature B	Type T Thermocouple	-328 to 662°F	T_tank1b	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, 18" long with sensing element at tip and 12" back from tip. Protected by Intrinsically Safe Circuit	UL	TT1b	P&F Z960
YTI	10302	Hydrogen Tank #1 - Inlet Gas Temperature	Type T Thermocouple	-328 to 662°F	T_inlet1	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, 18" long with sensing element at tip and 12" back from tip. Protected by Intrinsically Safe Circuit	UL	TT4	P&F Z960
YTI	10303	Hydrogen Tank #2 - Tank Internal Temperature A	Type T Thermocouple	-328 to 662°F	T_tank2a	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, 18" long with sensing element at tip and 12" back from tip. Protected by Intrinsically Safe Circuit	UL	TT2a	P&F Z960
YTI	10304	Hydrogen Tank #2 - Tank Internal Temperature B	Type T Thermocouple	-328 to 662°F	T_tank2b	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, 18" long with sensing element at tip and 12" back from tip. Protected by Intrinsically Safe Circuit	UL	TT2b	P&F Z960
YTI	10305	Hydrogen Tank #2 - Inlet Gas Temperature	Type T Thermocouple	-328 to 662°F	T_inlet2	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, 18" long with sensing element at tip and 12" back from tip. Protected by Intrinsically Safe Circuit	UL	TT5	P&F Z960
YTI	10306	Hydrogen Tank #3 - Tank Internal Temperature A	Type T Thermocouple	-328 to 662°F	T_tank3a	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, 18" long with sensing element at tip and 12" back from tip. Protected by Intrinsically Safe Circuit	UL	TT3a	P&F Z960
YTI	10307	Hydrogen Tank #3 - Tank Internal Temperature B	Type T Thermocouple	-328 to 662°F	T_tank3b	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, 18" long with sensing element at tip and 12" back from tip. Protected by Intrinsically Safe Circuit	UL	TT3b	P&F Z960
YTI	10308	Hydrogen Tank #3 - Inlet Gas Temperature	Type T Thermocouple	-328 to 662°F	T_inlet3	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, 18" long with sensing element at tip and 12" back from tip. Protected by Intrinsically Safe Circuit	UL	TT6	P&F Z960
YTI	10309	Receptacle Inlet Gas Temperature	Type T Thermocouple	-328 to 662°F	T_recep	Sandelius	2T-125T316-G-31/2-T1-120	Type T, 1/8"OD, Copper, 316 Shealth, Grounded Junction Single Element, 120" telfon cable w/SS overvraid. Protected by Intrinsically Safe Circuit	UL	TT7	P&F Z960
YTI	10310	Ambient Temperature	Type T Thermocouple	-328 to 662°F	T_amb	Sandelius	2T-125T316-G-31/2-T1-121	Type T, 1/8"OD, Copper, 316 Shealth, Grounded Junction Single Element, 120" telfon cable w/SS overvraid. Protected by Intrinsically Safe Circuit	UL	TT8	P&F Z960
YTI	10311	Spare Thermocouple Input: Terminated at ISB J/B 01 & prewired with IS Barrier.	Type T Thermocouple	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P&F Z960
YTI	10312	Spare Thermocouple Input: Terminated at ISB J/B 01 & prewired with IS Barrier.	Type T Thermocouple	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P&F Z960
YTI	10313	Spare Thermocouple Input: Terminated at ISB J/B 01 & prewired with IS Barrier.	Type T Thermocouple	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P&F Z960
YTI	10314	Spare Thermocouple Input: Terminated at ISB J/B 01 & prewired with IS Barrier.	Type T Thermocouple	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P&F Z960
YTI	10315	Spare Thermocouple Input: Terminated at ISB J/B 01 & prewired with IS Barrier.	Type T Thermocouple	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10400	Emergency Shutdown Circuit - cDAQ Shutdown Command	24VDC Sourcing Digital Output	N.O. dry contact / close during normal operation	ESD_COM	Omron	LY2N-D2	24VDC Relay DPDT, 12A 240VAC	CSA, CE, RU	R2	n/a
YDO	10401	Trailer Visual Alarm (Strobe)	24VDC Sourcing Digital Output	24VDC to alarm	VIS_ALM	e2s	IS-mC1	Array of 6 high intensity Red L.E.D's. Double flash at 2Hz and 1Hz. Combined 24V 30mA	Class 1 Div 2	n/a	n/a
YDO	10402	Trailer Audible Alarm (Siren)	24VDC Sourcing Digital Output	24VDC to alarm	AUD_ALM	e2s	IS-mC1	Audible alarm 24VDC, Class 1 Div 2100dB(A) @ 1m +/- 3dB - Tone 2* [91dB(A) @ 10ft/3m], Combined 24V 30mA	Class 1 Div 2	n/a	n/a
YDO	10403	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10404	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10405	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10406	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
YDO	10407	spare	24VDC Sourcing Digital Output	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

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3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

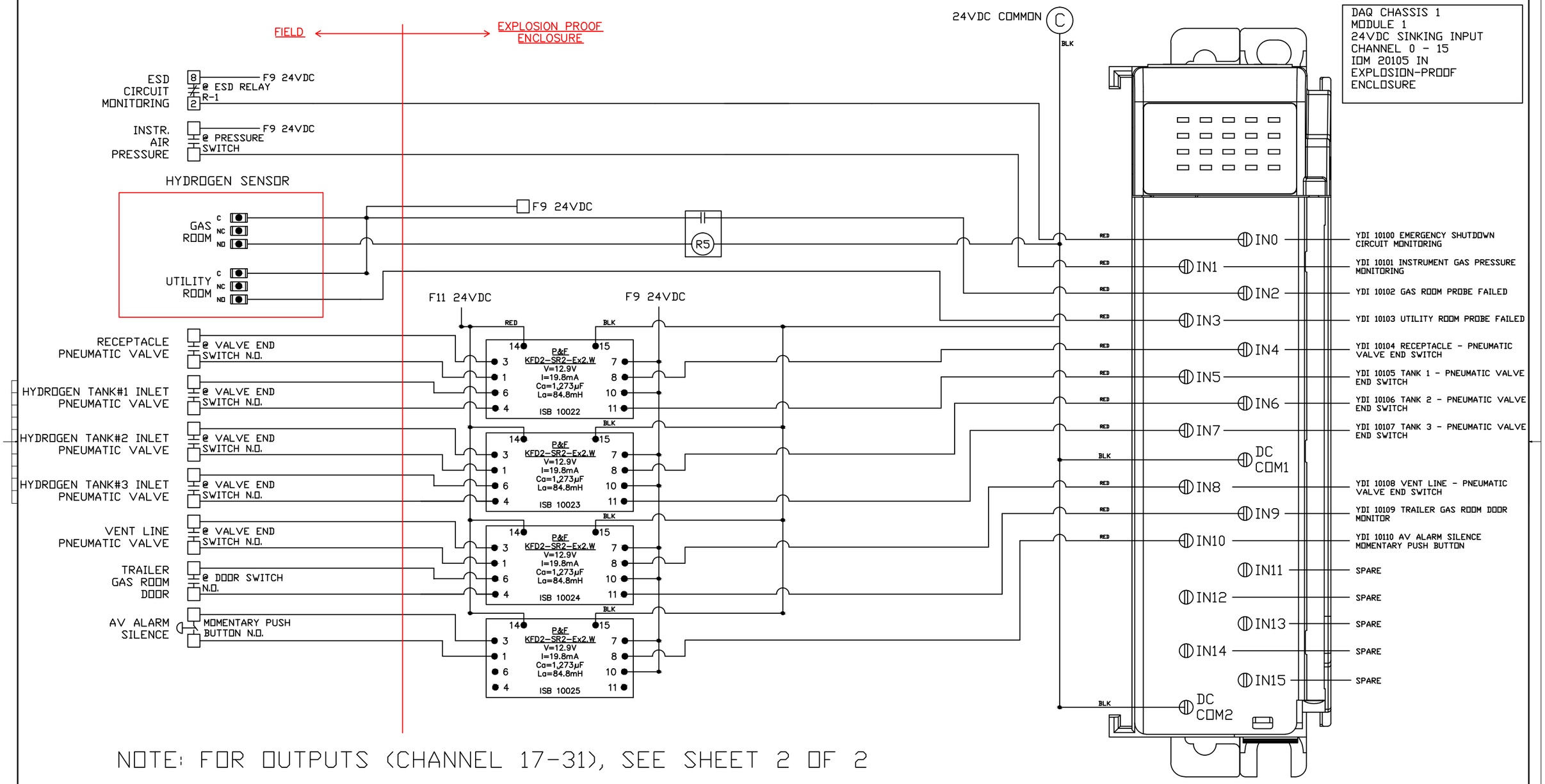
DRAWING NUMBER: PL-00742-11-07

SHEET: 2 OF 2

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: INPUT/OUTPUT POINTS LIST



NOTE: FOR OUTPUTS (CHANNEL 17-31), SEE SHEET 2 OF 2

NO.	REMARKS	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
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4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

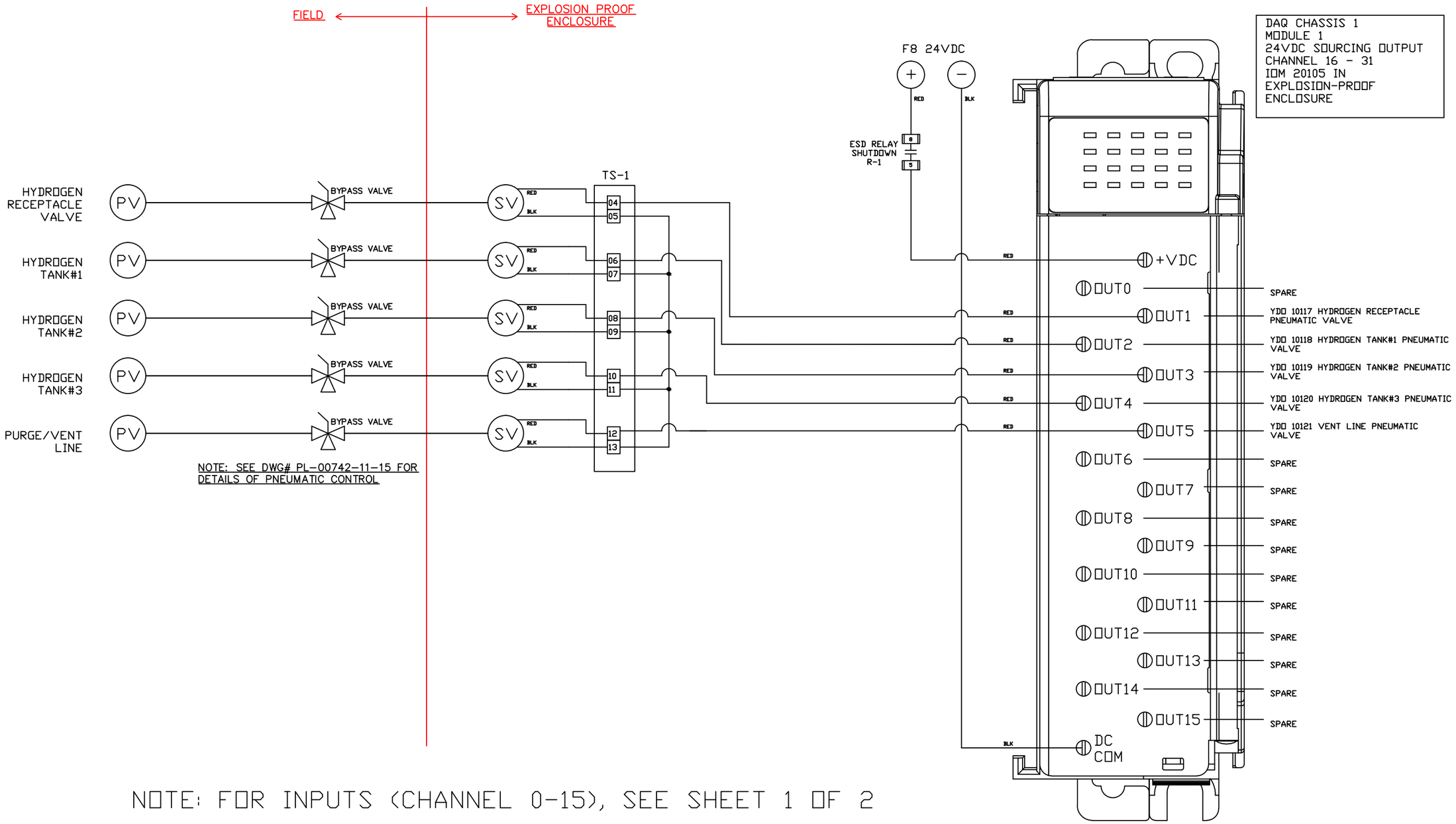
DRAWING NUMBER: PL-00742-11-08

SHEET: 1 OF 2

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: MODULE 1 DIGITAL INPUT/OUTPUT WIRING DETAILS



NOTE: FOR INPUTS (CHANNEL 0-15), SEE SHEET 1 OF 2

NO.	REMARKS	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
1	ISSUED FOR SECOND REVIEW	15MAR2015	BW	GM	GM
2	ISSUED FOR MATERIAL PROCUREMENT	01MAY2015	BW	GM	GM
3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

DRAWING NUMBER: PL-00742-11-08

SHEET: 2 OF 2

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: MODULE 1 DIGITAL INPUT/OUTPUT WIRING DETAILS

Hazardous (Classified) Location
Class 1, Division 2, Group B

Safe Location
Explosion-Proof Enclosure

INTRINSICALLY PROTECTED WIRING

TS-2 IN
INTRINSIC J/B#1

RECEPTACLE INLET PRESSURE — PT — BLK, WHT, SHD — 11, 12, 13 — 3-C1
HYDROGEN TANK#1 PRESSURE — PT — BLK, WHT, SHD — 15, 16, 14 — 3-C2
HYDROGEN TANK#2 PRESSURE — PT — BLK, WHT, SHD — 17, 18, 19 — 3-C3
HYDROGEN TANK#3 PRESSURE — PT — WHT, BLK, SHD — 10, 11, 12 — 3-C4

F9 24VDC

ISB 10001 — P&F Z787.F — Uo=28V, Io=93mA, Po=650mW — 3-C1 (WHT, BLK, SHD) — 1, 4 — 5 (RED), 8 (BLK)
ISB 10002 — P&F Z787.F — Uo=28V, Io=93mA, Po=650mW — 3-C2 (WHT, BLK, SHD) — 1, 4 — 5 (RED), 8 (BLK)
ISB 10003 — P&F Z787.F — Uo=28V, Io=93mA, Po=650mW — 3-C3 (WHT, BLK, SHD) — 1, 4 — 5 (RED), 8 (BLK)
ISB 10004 — P&F Z787.F — Uo=28V, Io=93mA, Po=650mW — 3-C4 (WHT, BLK, SHD) — 1, 4 — 5 (RED), 8 (BLK)

HYDROGEN SENSORS

GAS RM HYDROGEN LEVEL — CH1 4-20mA + / −
UTILITY RM HYDROGEN LEVEL — CH2 4-20mA + / −

TS-2 IN
INTRINSIC J/B#1

RED, BLK, SHD — 3-C1
RED, BLK, SHD — 3-C1

ISB 10001 — P&F Z787.F — Uo=28V, Io=93mA, Po=650mW — 3-C1 (WHT, BLK, SHD) — 1, 4 — 5 (RED), 8 (BLK)
ISB 10001 — P&F Z787.F — Uo=28V, Io=93mA, Po=650mW — 3-C1 (WHT, BLK, SHD) — 1, 4 — 5 (RED), 8 (BLK)

INTRINSICALLY PROTECTED WIRING

NOTE: SEE DWG# PL-00742-11-16 FOR DETAILS OF INTRINSIC SAFETY

C — 24VDC COM IN CONTROL PANEL — BLK

DAQ CHASSIS 1
MODULE 2
CURRENT ANALOG INPUT
IOM 20106 IN
EXPLOSION-PROOF
ENCLOSURE

IN0	YAI 10200 - RECEPTACLE INLET PRESSURE
IN1	YAI 10201 - HYDROGEN TANK#1 PRESSURE
IN2	YAI 10202 - HYDROGEN TANK#2 PRESSURE
IN3	YAI 10203 - HYDROGEN TANK#3 PRESSURE
IN4	YAI 10204 - GAS ROOM HYDROGEN LEVEL
IN5	YAI 10205 - UTILITY ROOM HYDROGEN LEVEL
IN6	YAI 10206 - PRE-WIRED SPARE
IN7	YAI 10207 - PRE-WIRED SPARE
COM	
COM	
IN8	SPARE
IN9	SPARE
IN10	SPARE
IN11	SPARE
IN12	SPARE
IN13	SPARE
IN14	SPARE
IN15	SPARE

REVISIONS

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4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

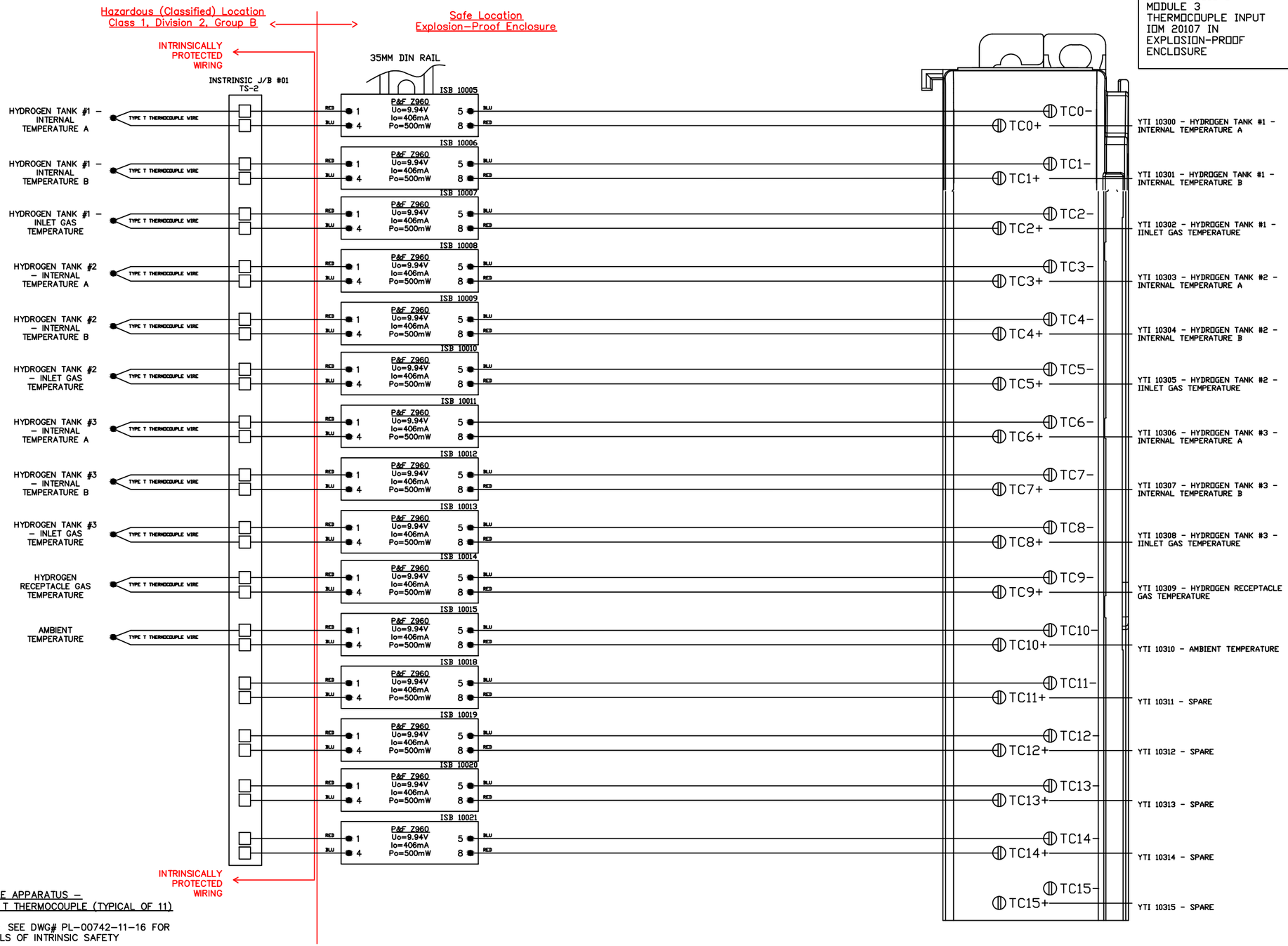
REFERENCE DRAWINGS/DOCUMENTS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

PROJECT NUMBER: PL-00742
DRAWING NUMBER: PL-00742-11-09
SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE
DRAWING TITLE: MODULE 2 ANALOG INPUT WIRING DETAILS



NO.	REMARKS	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
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2	ISSUED FOR MATERIAL PROCUREMENT	01MAY2015	BW	GM	GM
3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

DRAWING NUMBER: PL-00742-11-10

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: MODULE 4 THERMOCOUPLE WIRING DETAILS

FIELD ⟷ EXPLOSION PROOF ENCLOSURE

DAQ CHASSIS 1
MODULE 4
24VDC SOURCING OUTPUT
CHANNEL 0 - 7
IOM 20108 IN
EXPLOSION-PROOF
ENCLOSURE

F8 24VDC
+ RED
− BLK

ESD CIRCUIT SHUTDOWN

R2
F6 24VDC

VISUAL ALARM — VA

AUDIBLE ALARM — AA

R4
ESD RELAY
R-1

R3

TR1
TIMER RELAY TR-1
SET AT 5 MIN

RED +VDC
RED OUT0 — YDO 10400 EMERGENCY SHUTDOWN CIRCUIT MONITORING
RED OUT1 — YDO 10401 TRAILER VISUAL ALARM
RED OUT2 — YDO 10402 TRAILER AUDIBLE ALARM
OUT3 — SPARE
OUT4 — SPARE
OUT5 — SPARE
OUT6 — SPARE
OUT7 — SPARE
BLK DC COM

NO.	REMARKS	DATE	DRAWN	CHECKED	APPROVED
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REVISIONS

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REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

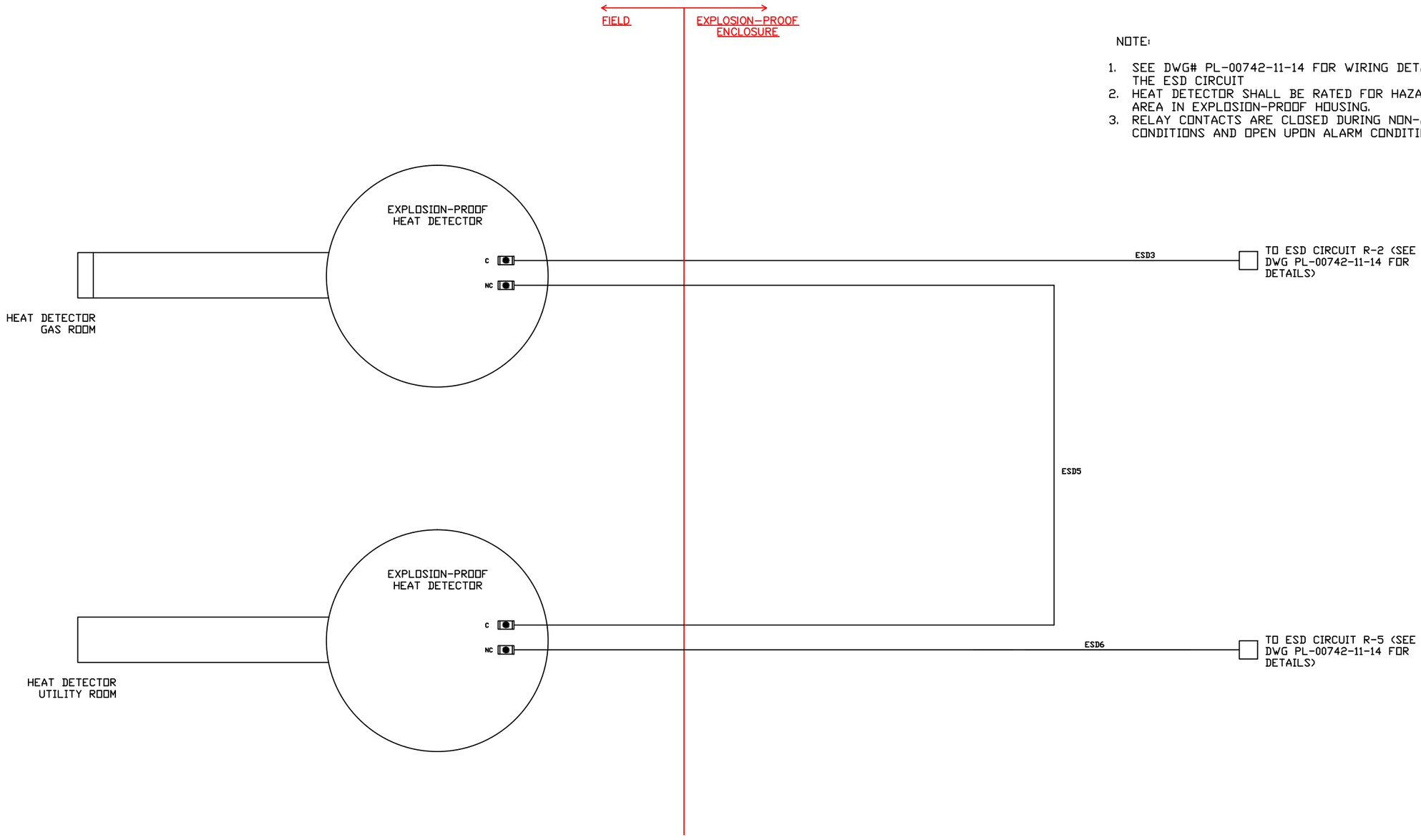
DRAWING NUMBER: PL-00742-11-11

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: MODULE 4 DIGITAL OUTPUT WIRING DETAILS



NOTE:

1. SEE DWG# PL-00742-11-14 FOR WIRING DETAILS OF THE ESD CIRCUIT
2. HEAT DETECTOR SHALL BE RATED FOR HAZARDOUS AREA IN EXPLOSION-PROOF HOUSING.
3. RELAY CONTACTS ARE CLOSED DURING NON-ALARM CONDITIONS AND OPEN UPON ALARM CONDITIONS.

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NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

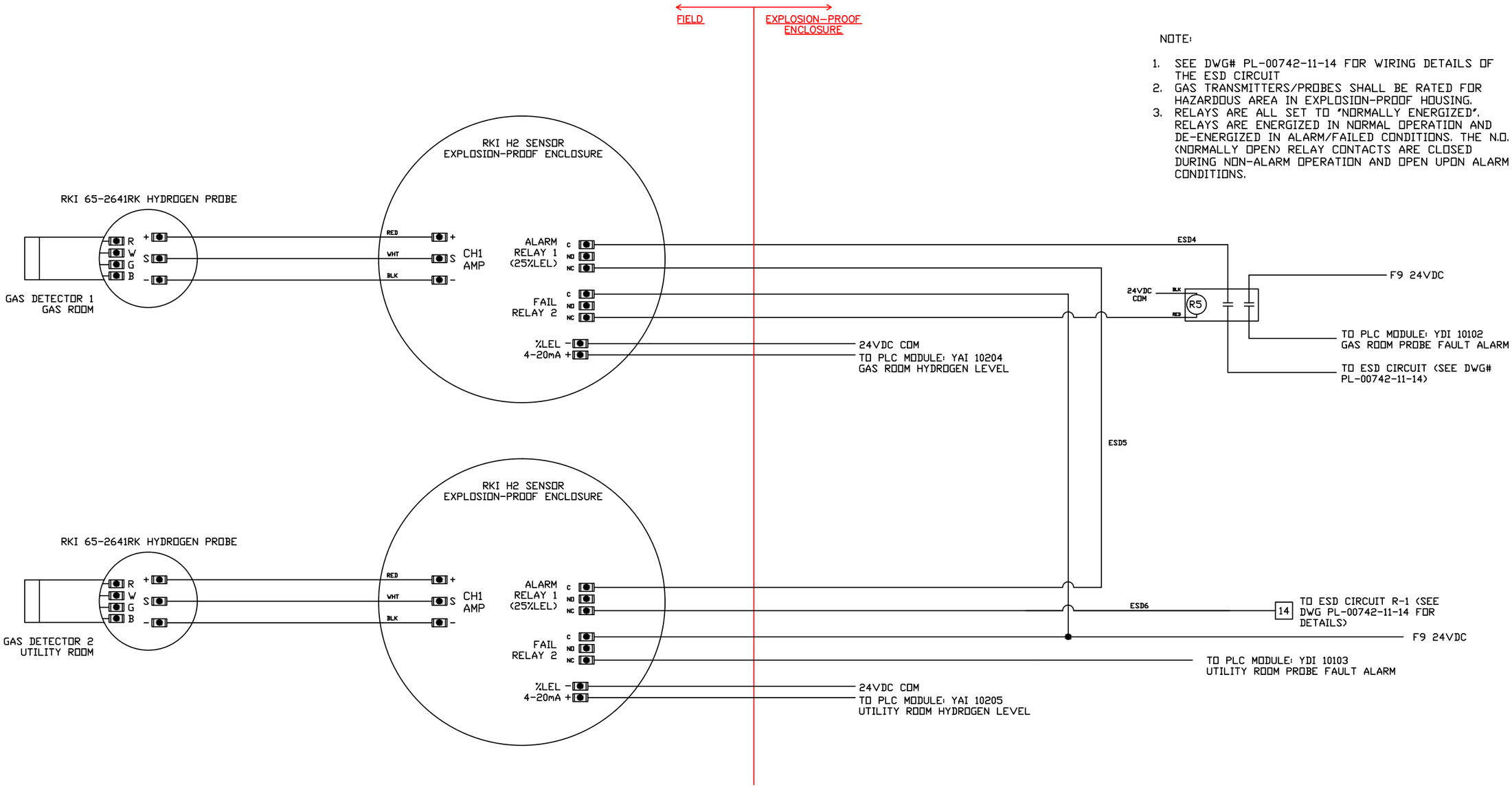
DRAWING NUMBER: PL-00742-11-12

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: FIRE DETECTION CIRCUIT WIRING DETAILS



NO.	REMARKS	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
1	ISSUED FOR SECOND REVIEW	15MAR2015	BW	GM	GM
2	ISSUED FOR MATERIAL PROCUREMENT	01MAY2015	BW	GM	GM
3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

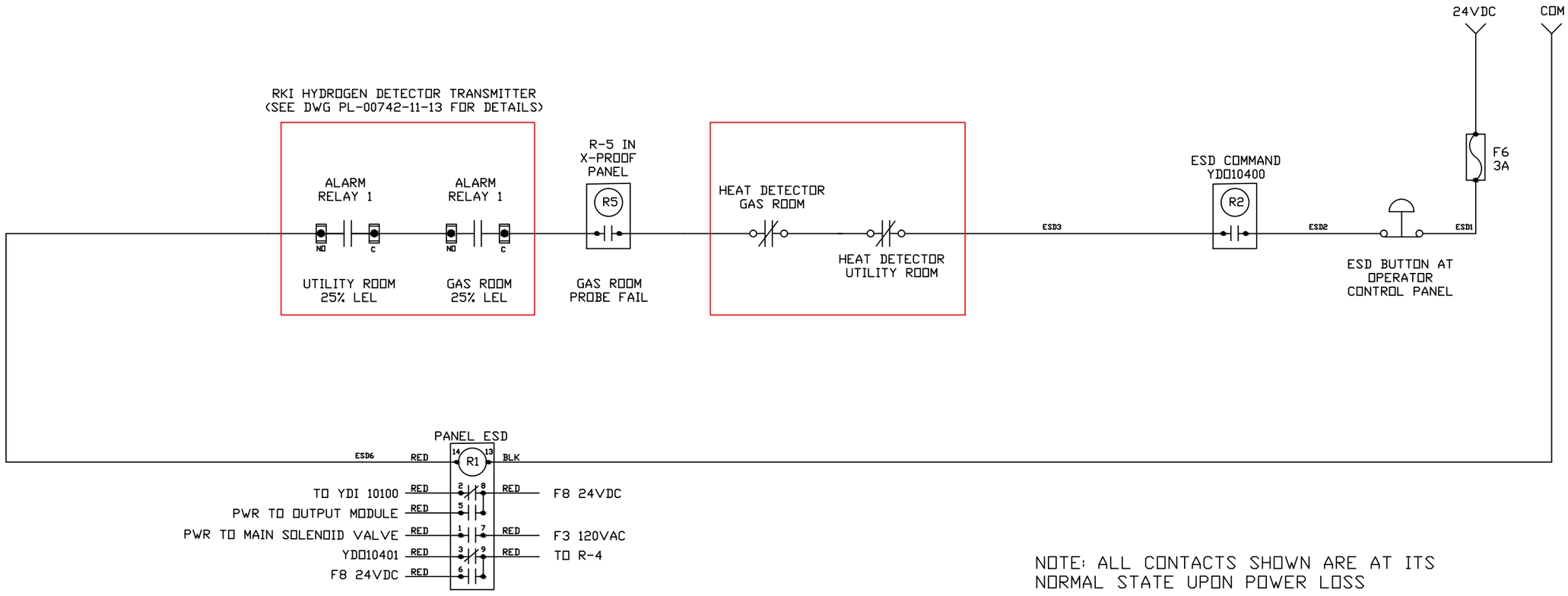
DRAWING NUMBER: PL-00742-11-13

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: GAS DETECTION PANEL WIRING DETAILS



NOTE: ALL CONTACTS SHOWN ARE AT ITS NORMAL STATE UPON POWER LOSS

NO.	REMARKS	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
1	ISSUED FOR SECOND REVIEW	15MAR2015	BW	GM	GM
2	ISSUED FOR MATERIAL PROCUREMENT	01MAY2015	BW	GM	GM
3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

DRAWING NUMBER: PL-00742-11-14

SHEET: 1 OF 1

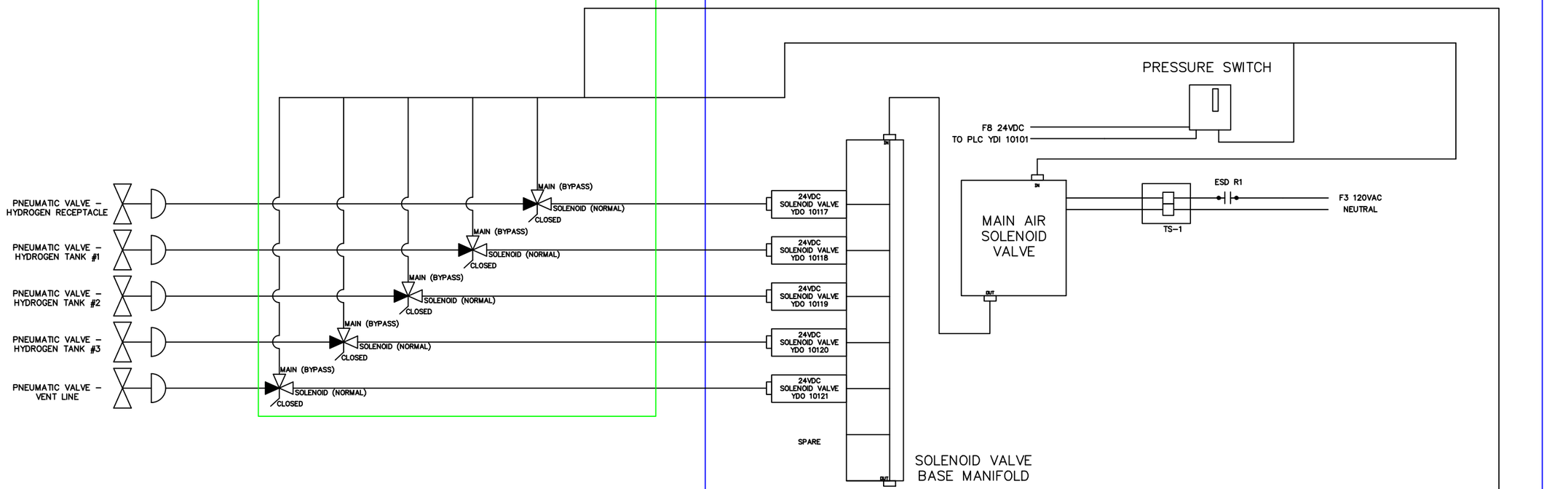
Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

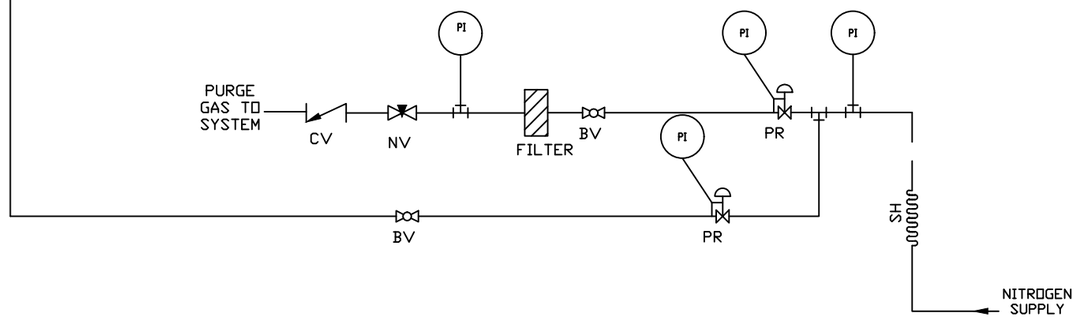
DRAWING TITLE: EMERGENCY SHUTDOWN (ESD) CONTROL CIRCUIT WIRING DETAILS

LOCK BOX
INSTRUMENT GAS BYPASS VALVES

EXPLOSION–PROOF ENCLOSURE



NOTE: ALL PNEUMATIC LINES ARE SAE J844 TYPE 3A $\frac{1}{4}$" OD UNLESS OTHERWISE NOTED



NO.	REMARKS	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
1	ISSUED FOR SECOND REVIEW	15MAR2015	BW	GM	GM
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3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS–BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL–00742

DRAWING NUMBER: PL–00742–11–15

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: PNEUMATIC CONTROL SYSTEM SCHEMATIC

Associated Apparatus (Intrinsically Safe Barrier)

Device ID	Model No.	Location	Polarity	Voc or Uo or Vt *for Multichannel* (V)	Isc or Io or It for Multichannel(mA)	Po (mW)	Group IIC (A,B) Ca or Co (μF)	La or Lo (μH)	La/Ra or Lo/Ro (μH/Ohm)
ISB 10001	P&F Z787.F	Explosion-Proof Enclosure	+	28	93	650	0.083	4110	13.7
ISB 10002	P&F Z787.F	Explosion-Proof Enclosure	+	28	93	650	0.083	4110	13.7
ISB 10003	P&F Z787.F	Explosion-Proof Enclosure	+	28	93	650	0.083	4110	13.7
ISB 10004	P&F Z787.F	Explosion-Proof Enclosure	+	28	93	650	0.083	4110	13.7
ISB 10005	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10006	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10007	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10008	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10009	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10010	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10011	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10012	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10013	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10014	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10015	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10016	P&F Z787.F	Explosion-Proof Enclosure	+	28	93	650	0.083	4110	13.7
ISB 10017	P&F Z787.F	Explosion-Proof Enclosure	+	28	93	650	0.083	4110	13.7
ISB 10018	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10019	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10020	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10021	P&F Z960	Explosion-Proof Enclosure	AC	9.94	406	500	3	190	0.6
ISB 10022	P&F KFD2-SR2-EX2W	Explosion-Proof Enclosure	+	12.9	19.8	34.0	1.273	84800.0	n/a
ISB 10022	P&F KFD2-SR2-EX2W	Explosion-Proof Enclosure	+	12.9	19.8	34.0	1.273	84800.0	n/a
ISB 10023	P&F KFD2-SR2-EX2W	Explosion-Proof Enclosure	+	12.9	19.8	34.0	1.273	84800.0	n/a
ISB 10023	P&F KFD2-SR2-EX2W	Explosion-Proof Enclosure	+	12.9	19.8	34.0	1.273	84800.0	n/a
ISB 10024	P&F KFD2-SR2-EX2W	Explosion-Proof Enclosure	+	12.9	19.8	34.0	1.273	84800.0	n/a
ISB 10024	P&F KFD2-SR2-EX2W	Explosion-Proof Enclosure	+	12.9	19.8	34.0	1.273	84800.0	n/a
ISB 10025	P&F KFD2-SR2-EX2W	Explosion-Proof Enclosure	+	12.9	19.8	34.0	1.273	84800.0	n/a
ISB 10025	P&F KFD2-SR2-EX2W	Explosion-Proof Enclosure	+	12.9	19.8	34.0	1.273	84800.0	n/a

Apparatus

PLC Point ID	PLC Point Desription	Location	Type (I.S. or Simple Apparatus)	Ui (V)	Ii (mA)	Ci (μF)	Li (μH)	Total Capacitance Ci + Cc (μF)	Total Inductance Li + Lc (μH)
YAI 10201	Receptacle Inlet Pressure	Gas Room	I.S.	36	100	0.024	2.7	0.033	32.7
YAI 10202	Hydrogen Tank #1 - Line Pressure	Gas Room	I.S.	36	100	0.024	2.7	0.033	32.7
YAI 10203	Hydrogen Tank #2 - Line Pressure	Gas Room	I.S.	36	100	0.024	2.7	0.033	32.7
YAI 10204	Hydrogen Tank #3 - Line Pressure	Gas Room	I.S.	36	100	0.024	2.7	0.033	32.7
YTI 10301	Hydrogen Tank #1 - Tank Internal Temperature A	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10302	Hydrogen Tank #1 - Tank Internal Temperature B	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10303	Hydrogen Tank #1 - Inlet Gas Temperature	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10304	Hydrogen Tank #2 - Tank Internal Temperature A	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10305	Hydrogen Tank #2 - Tank Internal Temperature B	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10306	Hydrogen Tank #2 - Inlet Gas Temperature	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10307	Hydrogen Tank #3 - Tank Internal Temperature A	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10308	Hydrogen Tank #3 - Tank Internal Temperature B	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10309	Hydrogen Tank #3 - Inlet Gas Temperature	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10310	Receptacle Inlet Temperature	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YTI 10311	Ambient Temperature	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.0054	18
YAI 10205	Spare	-	-	-	-	-	-	-	-
YAI 10206	Spare	-	-	-	-	-	-	-	-
YTI 10311	Spare	-	-	-	-	-	-	-	-
YTI 10312	Spare	-	-	-	-	-	-	-	-
YTI 10313	Spare	-	-	-	-	-	-	-	-
YTI 10314	Spare	-	-	-	-	-	-	-	-
YDI10104	Receptacle Pneumatic Valve End Switch	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.009	30
YDI10105	Hydrogen Tank#1 Inlet Pneumatic Valve End Switch	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.009	30
YDI10106	Hydrogen Tank#2 Inlet Pneumatic Valve End Switch	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.009	30
YDI10107	Hydrogen Tank#3 Inlet Pneumatic Valve End Switch	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.009	30
YDI10108	Vent Line Pneumatic Valve End Switch	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.009	30
YDI10109	Trailer Gas Room Door	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.009	30
YDI10110	AV Alarm Silence Button	Gas Room	Simple Apparatus	n/a	n/a	0	0	0.009	30
	Spare								

Cable

Type	Maximum Loop Length (ft)	Cc (μF)	Lc (μH)	Rc	Lc/Rc
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.38983
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.38983
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.38983
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.38983
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
KX20 PVC Type K Thermocouple Wire (P/N: A31-201010)	90	0.0054	18	n/a	n/a
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.4
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.4
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.4
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.4
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.4
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.4
Beldon 2P/18 Shielded (22405)	150	0.009	30	8.85	3.4

WARNING: ONLY THE FIELD DEVICE (APPARATUS) & THE INTRINSIC BARRIER (ASSOCIATED APPARATUS) SPECIFIED ABOVE SHALL BE USED. SUBSTITUTION OF FIELD DEVICES OR INTRINSIC BARRIERS OTHER THAN THOSE LISTED MAY JEOPARDIZE THE INTRINSIC SAFETY OF THE SYSTEM.

REVISIONS

NO.	REMARKS	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
1	ISSUED FOR SECOND REVIEW	15MAR2015	BW	GM	GM
2	ISSUED FOR MATERIAL PROCUREMENT	01MAY2015	BW	GM	GM
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4	AS–BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REFERENCE DRAWINGS/DOCUMENTS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

PROJECT NUMBER: PL–00742

DRAWING NUMBER: PL–00742–11–16

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: LIST OF INTRINSIC SAFETY DEVICES

Location	Device Tag	Description	Manufacturer	Part Number	Details	Certification
Gas Room	JB	I.S. JB 1 Junction Box	Hoffman	A10106PHC	Type 4, 4x,12, 13	$_{c}UL_{US}$
Gas Room	JB	Valve Override Junction Box	Hoffman	A10106PHC	Type 4, 4x,12, 13	$_{c}UL_{US}$
Gas Room	JB	I.S. JB 2 Junction Box	Hoffman	A664PHC	Type 4, 4x,12, 13	$_{c}UL_{US}$
Gas Room	TS	Terminal Blocks	Weidmuller	WDU 2.5.WPE 2.5	Non-Incendive Device installed in IS Junction Box	UL
Gas Room	LT	Area Lighting	Nemalux	GSLEDIP48-CW-WF-BLK-C1D2	24VDC, 1.4A. Class I, Division 2, Group A,B,C,D T5	UL
Gas Room	HGD	Hydrogen Gas Detector	RKI Instruments INC	65-2641RK/H2	Hydrogen %LEL, 4-20mA, 2 Programmable Alarm Relays & Fail Relay, Explosion-Proof, Direct Digital Readout	UL
Gas Room	HD	Heat Detector	Kidde-Fenwal	27120-22	N.C. Open on Temperature Rise. Class I, Division 2, Group A,B,C,D T5	UL
Gas Room	PT	Pressure Transducer	Stellar Technologies	GT2250-15000G-215	15,000psig, 24VDC, 4-20mA, Hazardous Area Rated, 9/16-18 UNF connection.	UL
Gas Room	TT	Thermocouple - Single Element	Sandelius	2T-125T316-G-31/2-T1-120	Type T, 1/8"OD, Copper, 316 Shealth, Grounded Junction Single Element, 120" telfon cable w/SS overvraid. Protected by Intrinsically Safe Circuit	UL
Gas Room	TD	Thermocouple - Dual Element	Sandelius	MPV0331U	Type T, 1/8"OD, Copper, 316 Shealth, Grounded Junction Dual Element, 18" long with sensing element at tip and 12" back from tip, 120" telfon cable w/SS overvraid. Protected by Intrinsically Safe Circuit	UL
Gas Room	AVS	Air Solenoid Valve End Switch (Close Position) x 5	Philmore (LKG INDUSTRIES)	30-2040	Mini Snap Action Switch with Long Lever, SPDT, 0.5A -125VDC	RU
Gas Room	DS	Trailer Gas Room Door Monitor	Omron	D4A-1101N	Mechanical Position Switch with Lever, DPDT	UL
Gas Room	RA	Remote Antenna for Cellular Modem	Taoglas	G24.A.305111	GSM/GPRS/CDMA/HSPA, Heavy duty screw mount UV and vandal resistant PC housing and thread IP67 compliant, ROHS Compliant	UL
X-Proof Enc (Utility Rm)	ENC	Control Panel	Akron Electric	24368 AXJ Series	Explosion Proof Enclosure External:W30"xH42"xD11 1/8. Internal: W24"xH36"xD8"	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	DAQ	DAQ CPU	National Instrument	NI 9132	General Purpose	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	DAQ	DAQ Chassis - Power Supply - 120VAC-24VDC, 5A	National Instrument	NI PS-15	General Purpose	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	IOM	DAQ Module 1 - 32 channel 24 VDC Sinking Input/Sourcing Output Module	National Instrument	NI 9375	Class I, Division 2, Group A,B,C,D T4	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	IOM	DAQ Module 2 - 16 Channel Analog Current Input Module	National Instrument	NI 9208	Class I, Division 2, Group A,B,C,D T4	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	IOM	DAQ Module 3 - 16 Channel Thermocouple/Mv Input Module	National Instrument	NI 9213	Class I, Division 2, Group A,B,C,D T4	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	IOM	DAQ Module 4 - 8 channel 24 VDC Sourcing Output Module	National Instrument	NI 9472	Class I, Division 2, Group A,B,C,D T4	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	ISB	I.S. Barrier x 15	Pepperl + Fuchs	Z960	Thermocuple. Class I, Division 2, Group A,B,C,D	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	ISB	I.S. Barrier X 6	Pepperl + Fuchs	Z787.F	4-20mA Analogy. Class I, Division 2, Group A,B,C,D	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	ISB	I.S. Barrier X 4	Pepperl + Fuchs	KFA5-SR2-EX2W	Digital Input. Class I, Division 2, Group A,B,C,D	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	PSU	Power Supply	ABB	CP-E 24/10	115-230 VAC to 24VDC, 10A	UL
X-Proof Enc (Utility Rm)	PSU	Power Supply	Omron	S82K-00712	120VAC to 12VDC, 0.6A	$_{c}UL_{US}$
X-Proof Enc (Utility Rm)	FH	Fuse Holders (24VDC)	Weidmuller	WSI-6	General Purpose F1-F4	UL
X-Proof Enc (Utility Rm)	FH	Fuse Holders (24VDC)	Weidmuller	WSI-6/2	General Purpose F5-F12	UL
X-Proof Enc (Utility Rm)	FUS	Fuses	BUSS	AGC-3, AGC-5	General Purpose (250V-3A/5A, Fast Acting)	UL, CSA
X-Proof Enc (Utility Rm)	RY	Relay (R-2 to R-5)	Omron	LY2N	24VDC	CSA,CE, RU
X-Proof Enc (Utility Rm)	APS	Instrument Gas Pressure Switch	SMC	IS3000-N02L5	DC24V4A, 0.1-0.7 MPa	n/a
X-Proof Enc (Utility Rm)	MAS	Instrument Air Main Shut Off Solenoid Valve	SMC	VS 3115-0230T	110VAC	n/a
X-Proof Enc (Utility Rm)	SV	Solenoid Valve	SMC	VQZ312-5M1-02T	24VDC Solenoid Open/Close Valve	n/a
X-Proof Enc (Utility Rm)	TS	Terminal Blocks	Weidmuller	Weidmuller	General Purpose for 120VAC/24VDC	UL
X-Proof Enc (Utility Rm)	TS	Terminal Blocks	Weidmuller	DK4Q	General Purpose for Thermocouples	CSA
X-Proof Enc (Utility Rm)	R1	Relay R-1	Omron	LY3N	24VDC	CSA,CE, RU
X-Proof Enc (Utility Rm)	TR	Time Relay TR-1	Omron	HY3N	24VDC with Timer Delay	CSA,CE, RU
X-Proof Enc (Utility Rm)	IRG	IrDA Signal Generator	IRDI	200016	Test Signal Generator with Modbus Input, 120VAC	UL
X-Proof Enc (Utility Rm)	CM	Celluar Modem	Sierra Wireless	LS300	Airlink LS300 Cellular Modem for Verizon (925-784-3918)	UL
X-Proof Enc (Utility Rm)	ES	Ethernet Switch	GE	ML600	MultiLink 6 port ethernet switch, 12VDC, 0.8A max.	UL
Utility Room	LT	Area Lighting	Nemalux	GSLEDIP48-CW-WF-BLK-C1D2	24VDC, 1.4A. Class I, Division 2, Group A,B,C,D T5	UL
Utility Room	EJ	Ethernet Receptable	Amphenol	RJFTVX7SA1N	ATEX ZONE 2 JAMNUT RECEPTACLE; RJ45 TERMINATION; NICKEL PLATED; CODE A	UL
Utility Room	HD	Heat Detector	Kidde-Fenwal	27120-22	N.C. Open on Temperature Rise. Class I, Division 2, Group A,B,C,D T5	UL
Utility Room	HGD	Hydrogen Gas Detector	RKI Instruments INC	65-2641RK/H2	Hydrogen %LEL, 4-20mA, 2 Programmable Alarm Relays & Fail Relay, Explosion-Proof, Direct Digital Readout	UL
Operator Control Panel	ACK	Audible/Visual Alarm Ack/Silent Push Button	ABB	CP1-10G-10	Momentary push button (N.O.), SPST, IEC60947-5-1	UL
Operator Control Panel	HMI	15" HMI	AIS	HAR15L600-A1FTE-5RT	15” Full IP65 stainless steel display monitor, 1024x768, 1000nits, 1 x RS-232, 2 x USB, 1 x LAN, 1 x 12V DC power (9-36VDC) input, resistive touch screen, VGA, operating temperature of -20c~60c, C1D2 listed, sunlight readable	$_{c}UL_{US}$ (Class 1, Div 2 Group A,B,C,D T4)
Operator Control Panel	ESD	ESD Push Button	Appleton	EFDCB175UM1	Heavy Duty, Class I, Group BCD 600VAC. Push to activate and pull to reset.	$_{c}UL_{US}$
Operator Control Panel	AA	AudibleAlarm	e2s	IS-mC1	Audible alarm 24VDC, Class 1 Div 2100dB(A) @ 1m +/- 3dB - Tone 2* [91dB(A) @ 10ft/3m], Combined 24V 30mA	$_{c}UL_{US}$ (Class 1, Div 2 Group A,B,C,D T4)
Operator Control Panel	VA	Visual Alarm	e2s	IS-mC1	Array of 6 high intensity Red L.E.D’s. Double flash at 2Hz and 1Hz. Combined 24V 30mA	$_{c}UL_{US}$ (Class 1, Div 2 Group A,B,C,D T4)
Operator Control Panel	IR	IrDA Signal Transmitter	IRDI	200081	5V IR Signal Transmitter, RS232 Serial DB9 Connetor, J2799 format	Class 1, Div 2 Group A,B,C,D T4

NOTE: MISCELLANEOUS GENERIC ELECTRICAL SUPPLIES ARE NOT LISTED ABOVE

NO.	REMARKS	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR INTERNAL REVIEW	12FEB2015	BW	GM	GM
1	ISSUED FOR SECOND REVIEW	15MAR2015	BW	GM	GM
2	ISSUED FOR MATERIAL PROCUREMENT	01MAY2015	BW	GM	GM
3	ISSUED FOR CONSTRUCTION AFTER TRAILER INSPECTION	08MAY2015	BW	GM	GM
4	AS-BUILT ISSUED FOR REVIEW & APPROVAL	31AUG2015	BW	GM	GM

REVISIONS

NO.	REMARKS	DATE	AUTHOR	REF#	VERSION

REFERENCE DRAWINGS/DOCUMENTS

PROJECT NUMBER: PL-00742

DRAWING NUMBER: PL-00742-11-17

SHEET: 1 OF 1

Powertech

PROJECT TITLE: HYDROGEN STATION TESTING DEVICE

DRAWING TITLE: BILL OF ELECTRICAL MATERIALS