

TB-2363

GENERAL PRODUCT SPECIFICATION FOR Paladin HD and HD2™
INTERCONNECT SYSTEMS

Revision “D”

Specification Revision Status

Revision	SCR No.	Description	Initial	Date
A	S9527	Initial Pre-Release	J Dunham	12/21/21
B	S10704	Engagement force value and drill size updated	S Demian	7/20/23
C	S10873	Separation force value updated	K Vlack	11/10/23
D	S10980	Updated Document to reflect Paladin HD2	A Nachankar	01/22/24

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1.0 **SCOPE**

1.1 Content

1.1.1 This specification covers the performance, test and quality requirements for the Paladin HD and HD2 interconnect system. These connectors are two-piece devices that connect two printed circuit boards. Receptacle connectors and pin connectors are through hole devices with eye-of-the-needle compliant pin contacts as well as compression contacts. The Paladin HD and HD2 connector family consists of modular configurations with custom guidance modules.

1.1.2 Paladin HD and HD2 specification covers the traditional daughtercard to backplane, orthogonal midplane, direct orthogonal (no midplane), cabled backplane and mezzanine.

1.2 Qualification

1.2.1 When tests are performed on subject product line, procedures specified in EIA-364-B shall be used per the test sequences outlined in Amphenol TCS Technical Bulletin TB-2023. All inspections shall be performed using applicable inspection plan and product drawings.

2.0 **REFERENCE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein.

2.1 Amphenol TCS Documents

2.1.1 TB-2023 Amphenol TCS Commercial Connector Qualification Plan

2.1.2 TB-2357 Paladin HD and HD2 Direct Ortho General Guidelines

2.1.3 TB-2360 Paladin HD and HD2 Routing Guidelines

2.1.4 TB-2362 Paladin HD and HD2 Right Angle Press Fit Installation Guidelines

2.1.5 TB-2364 Paladin HD and HD2 Right Angle Connector Removal

2.2 Commercial Standards

2.2.1 EIA-364 Electrical Connector Test Procedure Including Environmental Classifications

2.2.2 GR-1217-CORE - Generic Requirements for Separable Electrical Connectors Used in Telecommunications Hardware

2.2.3 GR-78-CORE - Generic Requirements for the Physical Design and Manufacture of Telecommunications Products and Equipment

2.2.4 IEC-512 - Electromechanical Components for Electronic Equipment – Basic Testing, Procedures and Measuring Methods

3.0 **BASE MATERIAL and FINISHES**

3.1 Contacts

3.1.1 Signal contacts are high performance copper alloy. Contacts are plated with a noble metal at the separable interface and PCB interface per EGS205.

3.1.2 Shield blades are high performance copper alloy. Contacts are plated with a noble metal at the separable interface per EGS205. The PCB interface is generally plated with Sn.

Notes:

1. All contacts meet lead free requirements, refer to EGS205

3.2 Sub Components –

Component	Material	Specification
Insulative Dielectric	Glass Reinforced Polyester (LCP)	UL 94V-0 Rating, Color natural
Non-Insulative Plastic	Reinforced Nylon	UL 94V-0 Rating, Color Black
Stiffener	Stainless steel, Type 301	N/A
Screw Down Endcaps	Die Cast Zinc	Per EGS205
Backplane Guide Pins and Keys	Stainless steel	QQ-S-764, CL 303 or 303 SE Condition A

4.0 LENGTH OF TRACES & MATED BULK RESISTANCE – Paladin HD and HD2™

4.1 Paladin HD and HD2 Direct Orthogonal Connectors

Differential Pair	Contact Rows	DC Trace Length (mm)	DO Trace Length(mm)	DC Resistance (mΩ)	DO Resistance (mΩ)
Signal Pair 1	A, B	10.2	22.3	21	44
Ground Shield Pair 1	Contacts 1-4	12.0	20.5	11	16
Signal Pair 2	C, D	14.7	26.8	25	48
Ground Shield Pair 2	Contacts 1-4	16.5	25.0	12	17
Signal Pair 3	E, F	19.1	31.2	29	52
Ground Shield Pair 3	Contacts 1-4	20.9	29.4	13	18
Signal Pair 4	G, H	23.6	59.3	34	57
Ground Shield Pair 4	Contacts 1-4	25.4	57.5	13	18
Signal Pair 5	J, K	29.3	41.4	39	62
Ground Shield Pair 5	Contacts 1-4	31.1	39.6	16	21
Signal Pair 6	L, M	33.8	45.9	42	65
Ground Shield Pair 6	Contacts 1-4	35.6	44.1	19	24
Signal Pair 7	N, P	38.2	50.3	51	74
Ground Shield Pair 7	Contacts 1-4	40.0	48.5	20	25
Signal Pair 8	Q, R	42.7	54.8	56	79
Ground Shield Pair 8	Contacts 1-4	44.5	53.0	20	25
Signal Pair 9	S,T	48.4	60.5	59	82
Ground Shield Pair 9	Contacts 1-4	50.2	58.7	21	26
Signal Pair 10	U,V	52.8	64.9	65	88
Ground Shield Pair 10	Contacts 1-4	54.7	63.1	21	26
Signal Pair 11	W,X	57.3	69.4	67	90
Ground Shield Pair 11	Contacts 1-4	59.1	67.6	21	26
Signal Pair 12	Y,Z	61.8	73.9	72	95
Ground Shield Pair 12	Contacts 1-4	63.6	72.1	25	30

Notes:

2. Mated bulk resistance values are typical values.
3. Mated trace lengths are taken from the DC board surface to the mating interface (assumes fully mated), including the compliant pin interface and compression springs.
4. For mated Direct Ortho total resistance – add the DC resistance and the DO resistance based on the appropriate pairs.
 - a. Refer to TB2357 for Direct Ortho pin out mapping.
5. Ground Shield and Signal Contacts are as follows (GC = Ground Contact, SH = Shadow via and S = Signal):

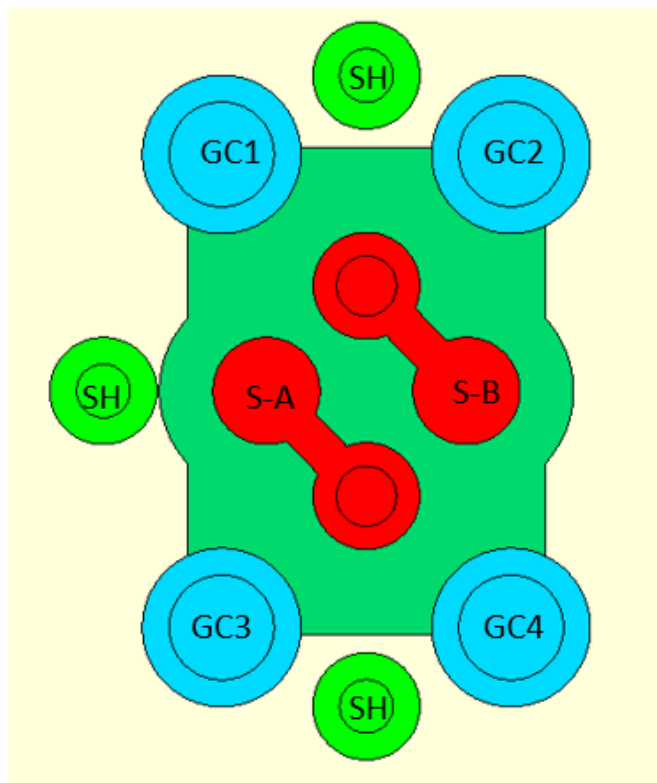


Figure 1: Footprint naming convention.

5.0 ELECTRICAL RATINGS

Description	Value
Mating Interface Contact Resistance Change	10mΩ Maximum
Compliant Pin to Plated Through Hole Resistance	1 mΩ Maximum
Insulation Resistance	1000 MegaΩ
Dielectric Withstanding Voltage	250 VAC Peak
Signal Compression Spring to Pad Resistance	10 mΩ

6.0 CURRENT AND TEMPERATURE RATINGS

Description	Value
Maximum operating temperature rating	85°C ⁽⁵⁾
Minimum operating temperature rating	-40°C

Notes:

- Per EIA-364-1000 the testing for 85°C (10 years) Field Temperature and Field Life at 105°C for 1,000 hours.

7.0 MECHANICAL RATINGS

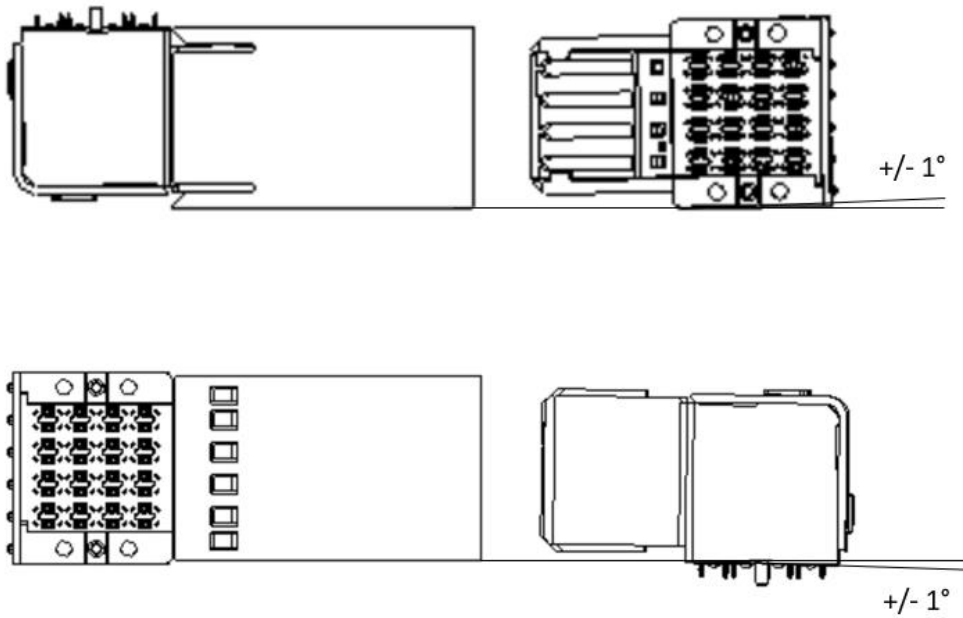
7.1 Mechanical Performance

Description	Paladin HD and HD2™	
	Grams	Value
Signal Contact Normal Force (End of Life)	30 min (EOL)	0.29 min (EOL)
Shield Contact Normal Force (End of Life)	30 min (EOL)	0.29 min (EOL)
Signal and Shield Engagement Force ⁽⁷⁾⁽⁸⁾	120 max	1.18 max
Signal and Shield Separation Force ⁽⁷⁾⁽⁹⁾	40 min	0.39 min
Signal and Shield Durability	Rated for 200 Mating Cycles	
Contact Mechanical Wipe Minimum Values	Signal	2.0mm/1.5mm
	Shield	2.5mm

Notes:

- These values are maximum and minimum expected forces, averaged over one differential pair in a connector. This data is to be used for purposes of system mechanical sizing.
- The average Signal and Shield Engagement Force shall be no greater than 120 grams (1.18 N) per one differential pair in a connector.
- The average Signal and Shield Separation Force values shall be no less than 40 grams (0.39N) per one differential pair in a connector.
- Sample Calculation: For a 4X4 connector, there are 16 differential pairs per connector allowing a maximum engagement force of: 1920 grams (120X16).

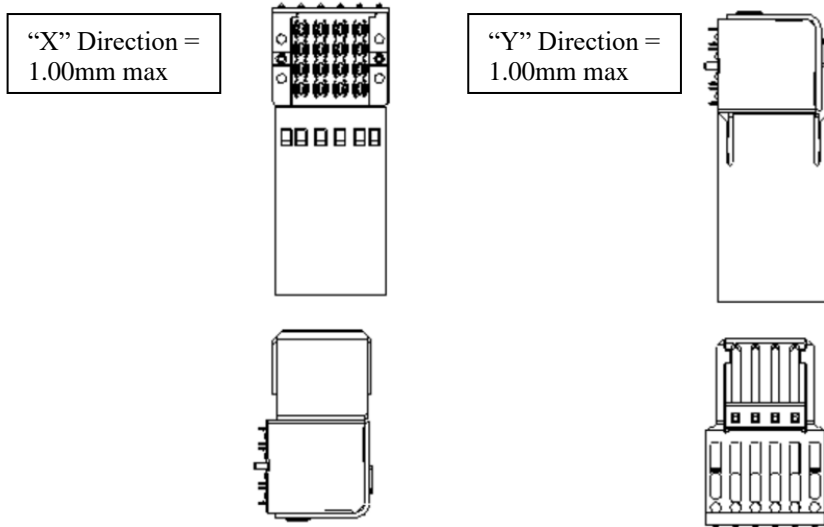
7.2 Connector Mating Angle



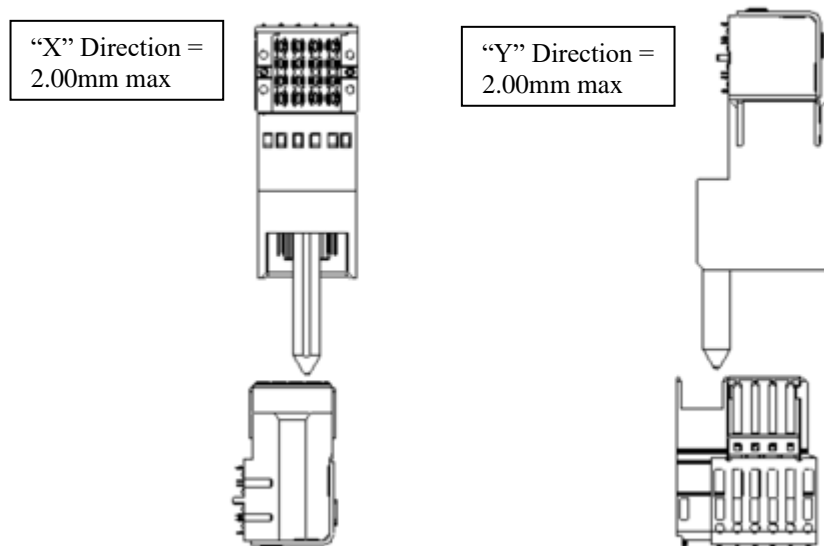
7.2.1 The maximum mating angle allowable in the X and Y axis is 1 degree.

7.3 Connector Gather-ability

7.3.1 Without Guide Module X & Y = 1mm Max



7.3.2 With Guide Module X & Y = 2mm Max



7.4 Sequencing chart

7.4.1 Consult factory for sequencing charts.

8.0 COMPLIANT PIN INTERFACE Paladin HD and HD2

Description	Value per Pin, lbs
0.0137" or 0.0145" Drill (Paladin HD and HD2 DC/BMA Pin)	
Shield Compliant Pin Insertion	5.0 Maximum ⁽¹⁰⁾
Shield Compliant Pin Retention	0.2 Minimum ⁽¹¹⁾
Signal Compression Spring Force	40 Grams minimum EOL

- 8.1 Radial hole deformation not to exceed 70µm (0.0015") measured from drilled hole.
- 8.2 Axial hole deformation not to exceed 50µm (0.00197") per IEC 60352-5 measured in the vertical plane.
- 8.3 Three pin insertions max per Plated Through Holes (PTH).

Notes:

- 10. Ensure press machine can reach maximum force required to press connector with a safety factor of 1.2 [Maximum force= (Max value per pin)(1.2) (Number of pins on connector)].
- 11. The average compliant pin retention shall not be less than 0.2 lbf.
- 12. Refer to technical bulletin TB-2360, Paladin HD and HD2 Routing Guidelines, for drilled and finished hole requirements. Refer to technical bulletin TB-2357, Paladin HD and HD2 Direct Ortho General Guidelines for pin locations and callouts
- 13. Signal compression to PCB pad interface supports 3 placements (2x rework)

9.0 QUALIFICATION TESTING

- 9.1 Sample Selection: Refer to Section 13 for minimum recommended connector sample size.
- 9.2 Test Sequence: Qualification testing shall be performed per the sequences listed in Section 13 of this document.
- 9.3 The qualification for the Paladin HD and HD2 product line was performed with the 12 Pair x 12 position interconnect and by similarity all other derivatives of the product line are considered qualified.

10.0 REQUALIFICATION TESTING

- 10.1 If changes affecting form, fit or function are made to the product or to the manufacturing process, Product Engineering and Mechanical Integrity Engineering shall coordinate re-qualification testing of all or part of the original testing sequence as required.

11.0 ACCEPTANCE

- 11.1 Acceptance is based on verification that the product meets the requirements of Section 12. Failures attributed to equipment, test set-up, or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for qualification. Verification of corrective action is required before re-submittal.

12.0 SPECIFICATION SUMMARY

12.1 Material

Parameters	Typical Specification	Paladin HD and HD2 Value	Reference Document
Plating Integrity	Acceptable Porosity	No more than 3 Pores per mating surface ⁽¹⁴⁾	EIA-364-TP53 Exposed to nitric vapors
Contact Metallization	Noble metal over Ni	Noble metal over Ni per EGS205	GR-1217-CORE Per section 6.1.8
Durability	200 Cycles	200 Cycles	GR-1217-CORE Per paragraph 9.1.1.2 EIA-364-TP09
Surface Finish	Surface finish is 16 RMS or otherwise specified	16 RMS on mating surfaces	GR-1217-CORE Per section 6.1.9
Lubrication	Must be present on all backplane blades/shields	Must be present on all backplane male pins/shield receptacles	GR-1217-CORE R5-67
Flammability Rating	94V-0	Must Pass Requirement	UL94

Notes:

14. Measured on as plated material prior to connector assembly.

12.2 Mechanical

Parameters	Specification	Paladin HD and HD2 Value	Reference Document
Contact Normal Force	30 Grams End of Life (EOL)	30 Grams End of Life (EOL)	GR-1217-CORE EIA-364-TP04
Contact Strength*	Apply 0.25 lbs. Axial Force per contact	Apply 0.25 lbs. Axial Force per contact	GB-1217-CORE Per paragraph 6.1.7
Polarization Force*	100 N (22.5 lbs)	Mate Samples 180° out of Phase	GR-78-CORE Per section 4.2.2

12.3 Electrical

Parameters	Specification	Paladin HD and HD2 Value	Reference Document
Contact Resistance Stability (LLCR)	Less than 10mΩ change from initial reading	Less than 10mΩ change from initial reading	GR-1217-CORE Per paragraph 6.2.1 EIA-364-TP23
Compliant Pin to PTH Resistance	No change greater than 1mΩ ⁽¹⁵⁾ Test current 100mA and 20mV open circuit	No change greater than 1mΩ	GR-1217-CORE EIA-364-TP23
Mated Bulk Resistance	N/A	SEE SECTION 4.0	N/A
Signal Continuity*	Less than 10 nanosecond interrupt	Less than 10 nanosecond Interrupt	GR-1217-CORE
Insulation Resistance	1,000 MegaΩ	1,000 MegaΩ	GR-1217-CORE
Dielectric Withstanding	250 VAC Peak	250 VAC Peak	GR-1217-CORE EIA-364-TP20

Notes:

15. Due to the size of the Paladin HD and HD2 compliant pins, direct probing of the compliant pins can disturb the compliant pin and PTH interface, yielding unreliable measurements. In lieu of direct probing, ATCS has developed a process to measure the compliant pin interface resistance without directly probing the compliant pins. This method does add some bulk resistance to the measurement, which is why a change in resistance is the critical metric. This technique complies with Telcordia requirements per paragraph R5-103.

12.4 Environmental

Parameters	Specification	Paladin HD and HD2 Value	Reference Document
Temperature Life*	No Change in LLCR greater than 10mΩ	10mΩ Maximum change	GR-1217-CORE EIA-364-TP17 Test condition 4 Per paragraph 6.3.2
Thermal Shock*	No Change in LLCR greater than 10mΩ 25 cycles for -65°C to 105°C	Same as above	GR-1217-CORE Per paragraph 6.3.3 EIA-364-TP32
Humidity Cycling*	No Change in LLCR greater than 10mΩ Relative Humidity 90 to 95% For 500 hrs	Same as above	GR-1217-CORE EIA-364-TP31 Procedure II
Dust*	No Change in LLCR greater than 10mΩ	Same as above	GR-1217-CORE Per paragraph 9.1.1.1 EIA-364-TP91
Vibration*	No Change in LLCR greater than 10mΩ Random Vibration 9.26 RMS	Same as above	GR-1217-CORE EIA-364-TP28 Per paragraph 9.1.2.1
Mechanical Shock*	No Change in LLCR greater than 10mΩ 50 G's for 11 milliseconds Half Sine 3 axis	Same as above	GR-1217-CORE EIA-364-TP27
Mixed Flowing Gas*	No Change in LLCR greater than 10mΩ 300 hrs at 105°C thermal conditioning also included	Same as above	GR-1217-CORE Per paragraph 9.1.3 EIA-364-TP65

Parameters marked with an asterisk () indicates that testing has not been performed/completed to this date.*

13.0 TELCORDIA QUALIFICATION TEST GROUP SUMMARY

13.1 Test Groups (Minimum 100 contacts per test group.)

Group 1: Vibration and mechanical shock with dust and durability

Group 2: Thermal shock and humidity with dust and durability

Group 3: Temperature life, 1000 hrs @ 105°C

Group 4: Mixed flowing gas, 4 gases with durability-thermal conditioning included prior to test.

Note: Compliant pins and compression springs are tested separately.

13.2.1 Definitions:

13.2.1.1 LLCR – Low Level Contact Resistance

13.2.1.2 DWV – Dielectric Withstanding Voltage

13.2.1.3 IR – Insulation Resistance

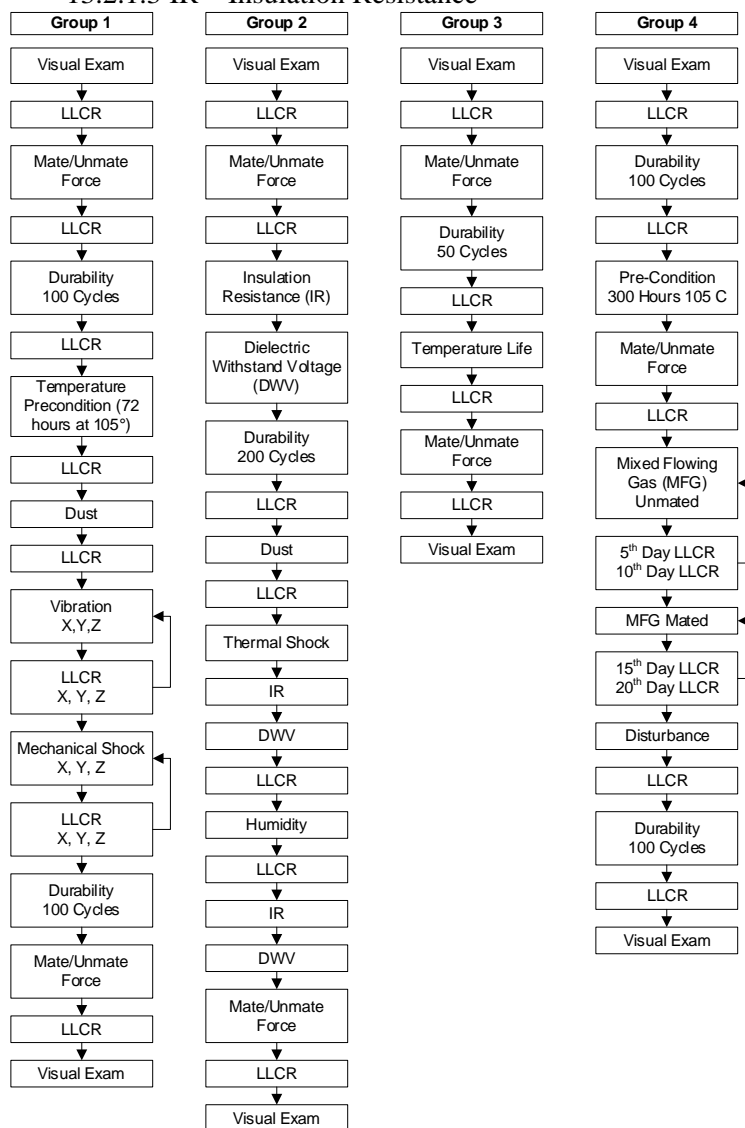


Figure 2: Telcordia Test Plan GR-1217-CORE, CENTRAL OFFICE

14.0 RESISTANCE MEASUREMENT SET-UP

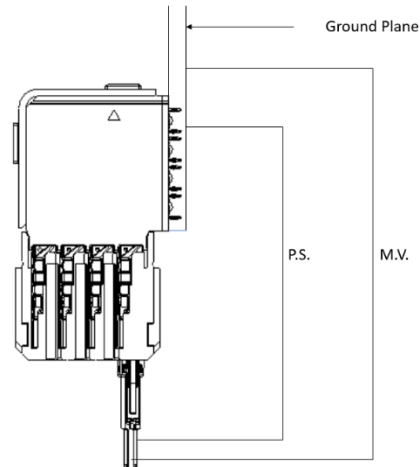


Figure 3: Shown above is an example of a typical contact resistance set-up. Kelvin 4 wire traces from connector hole to monitoring hole.

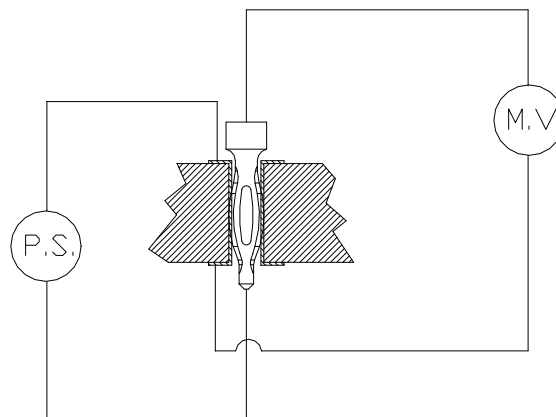


Figure 4: Typical compliant pin interface resistance (CPIR) set-up.