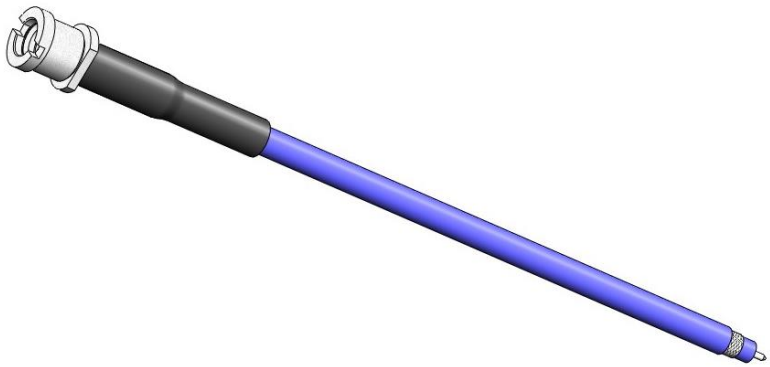
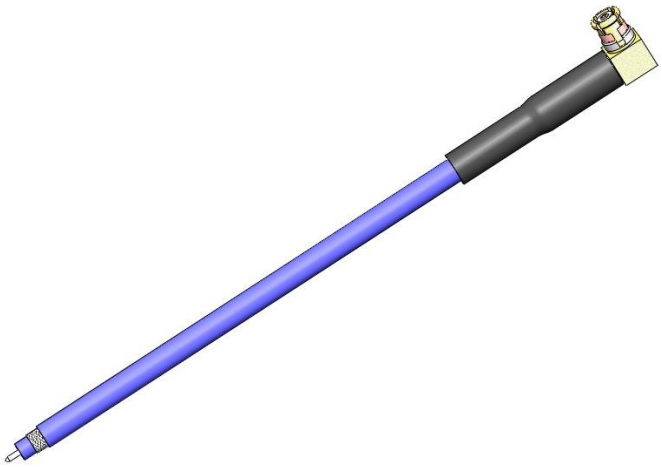
Project Number: Design Qualification Test Report	Tracking Code: CR-993801_Report_Rev_1
Requested by: Jenny Chou	Date: 1/16/2024
Part #: RF23C-00MJ-505050-0152	Mating part: RF23C-00BF/00BL/00BS-505050-0152
Part description: RF23C-00MJ/00BF/00BL/00BS	Tech: Keney Chen
Test Start: 8/4/2023	Test Completed:10/23/2023





DESIGN QUALIFICATION TEST REPORT

Part #:
RF23C-00MJ-505050-0152

Mating parts:
RF23C-00BF-505050-0152
RF23C-00BL-505050-0152
RF23C-00BS-505050-0152

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
1/12/2024	**1**	**Initial Issue**	**KC**

CERTIFICATION

All instruments and measuring equipment were calibrated to National Institute for Standards and Technology (NIST) traceable standards according to IS0 10012-l and ANSI/NCSL 2540-1, as applicable.

SCOPE

To perform the following tests: Design Qualification test. Please see test plan.

APPLICABLE DOCUMENTS

Standards: MIL-PRF-39012.

TEST SAMPLES AND PREPARATION

1) All materials were manufactured in accordance with the applicable product specification.
2) All test samples were identified and encoded to maintain traceability throughout the test sequences.
3) Parts not intended for testing LLCR and DWV/IR are visually inspected and cleaned if necessary.
4) Any additional preparation will be noted in the individual test sequences.

FLOWCHARTS

Mating/Unmating/Durability

Group 1 RF23C-00MJ-505050-0152 RF23C-00BF-505050-0152 4 Assemblies		Group 2 RF23C-00MJ-505050-0152 RF23C-00BL-505050-0152 4 Assemblies		Group 3 RF23C-00MJ-505050-0152 RF23C-00BS-505050-0152 4 Assemblies	
Step	**Description**	**Step**	**Description**	**Step**	**Description**
1.	Interface Gaging *Note: Contact location of 00BF is .045-.055 above reference plane; Contact depth of 00MJ is .000-.006*	1.	Interface Gaging *Note: Contact location of 00BL is .045-.055 above reference plane; Contact depth of 00MJ is .000-.006*	1.	Interface Gaging *Note: Contact location of 00BS is .045-.055 above reference plane; Contact depth of 00MJ is .000-.006*
2.	LLCR (1) - Non Standard *Note: initial LLCR measurement before mating cycles. Signal and ground*	2.	LLCR (1) - Non Standard *Note: initial LLCR measurement before mating cycles. Signal and ground*	2.	LLCR (1) - Non Standard *Note: initial LLCR measurement before mating cycles. Signal and ground*
3.	Mating/Unmating Force (2) - Non Standard disengagement force = 22 N engagement force = 68 N *Note: record engagement force (68 N max) and disengagement force (22 N min)*	3.	Mating/Unmating Force (2) - Non Standard engagement force = 45 N disengagement force = 9 N *Note: record engagement force (45 N max) and disengagement force (9 N min)*	3.	Mating/Unmating Force (2) - Non Standard engagement force = 9 N disengagement force = 2.2 N *Note: record engagement force (9 N max) and disengagement force (2.2 N min)*
4.	Cycles Quantity = 100 Cycles *Note: mate and unmate parts by hand or using mechanical means. MIL-PRF-39012, Paragraph 4.6.12*	4.	Cycles Quantity = 500 Cycles *Note: mate and unmate parts by hand or using mechanical means. MIL-PRF-39012, Paragraph 4.6.12*	4.	Cycles Quantity = 1000 Cycles *Note: mate and unmate parts by hand or using mechanical means. MIL-PRF-39012, Paragraph 4.6.12*
5.	Mating/Unmating Force (2) - Non Standard engagement force = 68 N disengagement force = 22 N *Note: record engagement force (68 N max) and disengagement force (22 N min)*	5.	Mating/Unmating Force (2) - Non Standard engagement force = 45 N disengagement force = 9 N *Note: record engagement force (45 N max) and disengagement force (9 N min)*	5.	Mating/Unmating Force (2) - Non Standard engagement force = 9 N disengagement force = 2.2 N *Note: record engagement force (9 N max) and disengagement force (2.2 N min)*
6.	LLCR (1) - Non Standard Max Delta = 15 mOhm	6.	LLCR (1) - Non Standard Max Delta = 15 mOhm	6.	LLCR (1) - Non Standard Max Delta = 15 mOhm
7.	Interface Gaging *Note: Contact location of 00BF is .045-.055 above reference plane; Contact depth of 00MJ is .000-.006*	7.	Interface Gaging *Note: Contact location of 00BL is .045-.055 above reference plane; Contact depth of 00MJ is .000-.006*	7.	Interface Gaging *Note: Contact location of 00BS is .045-.055 above reference plane; Contact depth of 00MJ is .000-.006*

(1) LLCR = Other
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max
MIL-PRF-39012, Paragraph 4.6.13 except current to be 100mA nominal and voltage to be 20 mV maximum.

(2) Mating/Unmating Force = Other
per DSCC 94008 drawing

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

LLCR:

1) MIL-PRF-39012, paragraph. 4.6.13 *except current to be 100mA nominal and voltage to be 20mV maximum.*
2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
3) The following guidelines are used to categorize the changes in LLCR as a result from stressing
    a. <= +5.0 mOhms: ----------Stable
    b. +5.1 to +10.0 mOhms: ----------Minor
    c. +10.1 to +15.0 mOhms:----------Acceptable
    d. +15.1 to +50.0 mOhms:----------Marginal
    e. +50.1 to +1000 mOhms: ----------Unstable
    f. >+1000 mOhms: ----------Open Failure

MATING/UNMATING:

1) Reference document: Per DSCC 94008 Drawing, *Mating and Unmating Forces Test Procedure for Electrical Connectors*.
2) The full insertion position was to within 0.003” to 0.004” of the plug bottoming out in the receptacle to prevent damage to the system under test.
3) One of the mating parts is secured to a floating X-Y table to prevent damage during cycling.

RESULTS

Interface Gaging

MUD Group

RF23C-00BF

Initial

- **Min ---------- 0.0450 inch (1.14mm)**
- **Max ---------- 0.0505 inch (1.28mm)**

After 100 Cycles

- **Min ---------- 0.0450 inch (1.14mm)**
- **Max ---------- 0.0455 inch (1.16mm)**

RF23C-00MJ

Initial

- **Min ---------- 0.0005 inch (0.01mm)**
- **Max ---------- 0.0015 inch (0.04mm)**

After 100 Cycles

- **Min ---------- 0.0000 inch (0.00mm)**
- **Max ---------- 0.0005 inch (0.01mm)**

RF23C-00BL

Initial

- **Min ---------- 0.0492 inch (1.25mm)**
- **Max ---------- 0.0508 inch (1.29mm)**

After 500 Cycles

- **Min ---------- 0.0488 inch (1.24mm)**
- **Max ---------- 0.0492 inch (1.25mm)**

RF23C-00MJ

Initial

- **Min ---------- 0.0016 inch (0.04mm)**
- **Max ---------- 0.0020 inch (0.05mm)**

After 500 Cycles

- **Min ---------- 0.0020 inch (0.05mm)**
- **Max ---------- 0.0024 inch (0.06mm)**

RF23C-00BS

Initial

- **Min ---------- 0.0488 inch (1.24mm)**
- **Max ---------- 0.0504 inch (1.28mm)**

After 1000 Cycles

- **Min ---------- 0.0484 inch (1.23mm)**
- **Max ---------- 0.0504 inch (1.28mm)**

RF23C-00MJ

Initial

- **Min ---------- 0.0012 inch (0.03mm)**
- **Max ---------- 0.0020 inch (0.05mm)**

After 1000 Cycles

- **Min ---------- 0.0016 inch (0.04mm)**
- **Max ---------- 0.0024 inch (0.06mm)**

RESULTS Continued

Mating/Unmating Forces

Mating-Unmating Durability (00MJ-00BF)

Engagement Force <= 68N
Separation Force >= 22N

- **Initial**
  - **Mating**
    - **Min ---------- 7.59 Lbs (33.76N)**
    - **Max----------12.12 Lbs (53.91N)**
  - **Unmating**
    - **Min ---------- 8.96 Lbs (39.85N)**
    - **Max---------- 11.64 Lbs (51.77N)**
- **After 100 Cycles**
  - **Mating**
    - **Min ---------- 7.07 Lbs (31.45N)**
    - **Max----------11.56 Lbs (51.42N)**
  - **Unmating**
    - **Min ---------- 9.85 Lbs (43.81N)**
    - **Max---------- 13.46 Lbs (59.87N)**

Mating/Unmating Forces

Mating-Unmating Durability (00MJ-00BL)

Engagement Force <= 45N
Separation Force >= 9N

- **Initial**
  - **Mating**
    - **Min ---------- 3.24 Lbs (14.41N)**
    - **Max---------- 6.39 Lbs (28.42N)**
  - **Unmating**
    - **Min ---------- 5.18 Lbs (23.04N)**
    - **Max---------- 7.08 Lbs (31.49N)**
- **After 500 Cycles**
  - **Mating**
    - **Min ---------- 4.59 Lbs (20.42N)**
    - **Max---------- 9.22 Lbs (41.01N)**
  - **Unmating**
    - **Min ---------- 5.94 Lbs (26.42N)**
    - **Max---------- 8.78 Lbs (39.05N)**

RESULTS Continued

Mating/Unmating Forces

Mating-Unmating Durability (00MJ-00BS)

Engagement Force <= 9N
Separation Force >= 2.2N

- **Initial**
  - **Mating**
    - **Min ---------- 1.42 Lbs (6.32N)**
    - **Max---------- 1.81 Lbs (8.05N)**
  - **Unmating**
    - **Min ---------- 1.05 Lbs (4.67N)**
    - **Max---------- 1.67 Lbs (7.43N)**
- **After 1000 Cycles**
  - **Mating**
    - **Min ---------- 1.51 Lbs (6.72N)**
    - **Max---------- 1.96 Lbs (8.72N)**
  - **Unmating**
    - **Min ---------- 1.26 Lbs (5.60N)**
    - **Max---------- 1.61 Lbs (7.16N)**

RESULTS Continued

Mating/Unmating Durability (4 ground and 4 signal LLCR test points)

RF23C-00MJ/RF23C-00BF

Ground pin

- **Initial ---------- 10.16 mOhms Max**
- **After 100 Cycles**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

Signal pin

- **Initial ---------- 22.35 mOhms Max**
- **After 100 Cycles**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

RF23C-00MJ/RF23C-00BL

Ground pin

- **Initial ---------- 9.86 mOhms Max**
- **After 500 Cycles**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

Signal pin

- **Initial ---------- 22.08 mOhms Max**
- **After 500 Cycles**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

RESULTS Continued

Mating/Unmating Durability (4 ground and 4 signal LLCR test points)

RF23C-00MJ/RF23C-00BS

Ground pin

- **Initial ---------- 10.02 mOhms Max**
- **After 1000 Cycles**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

Signal pin

- **Initial ---------- 22.57 mOhms Max**
- **After 1000 Cycles**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

DATA SUMMARIES

MATING-UNMATING FORCE:

Mating-Unmating Durability Group (00MJ-00BF)

	Initial				100 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	33.76	7.59	39.85	8.96	31.45	7.07	43.81	9.85
Maximum	53.91	12.12	51.77	11.64	51.42	11.56	59.87	13.46
Average	41.97	**9.44**	44.61	**10.03**	40.14	**9.03**	50.44	**11.34**
St Dev	8.58	1.93	5.26	1.18	8.30	1.86	6.82	1.53
Count	4	4	4	4	4	4	4	4

Mating-Unmating Durability Group (00MJ-00BL)

	Initial				500 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	14.41	3.24	23.04	5.18	20.42	4.59	26.42	5.94
Maximum	28.42	6.39	31.49	7.08	41.01	9.22	39.05	8.78
Average	19.97	**4.49**	28.38	**6.38**	27.47	**6.18**	33.98	**7.64**
St Dev	6.29	1.41	3.71	0.83	9.55	2.15	5.37	1.21
Count	4	4	4	4	4	4	4	4

Mating-Unmating Durability Group (00MJ-00BS)

	Initial				1000 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	6.32	1.42	4.67	1.05	6.72	1.51	5.60	1.26
Maximum	8.05	1.81	7.43	1.67	8.72	1.96	7.16	1.61
Average	7.26	**1.63**	6.09	**1.37**	7.56	**1.70**	6.44	**1.45**
St Dev	0.84	0.19	1.47	0.33	0.84	0.19	0.84	0.19
Count	4	4	4	4	4	4	4	4

DATA SUMMARIES Continued

LLCR Mating/Unmating Durability (00MJ-00BF):

1) A total of 4 signal and 4 ground points were measured.
2) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
3) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
4) The following guidelines are used to categorize the changes in LLCR as a result from stressing.
   a. <= +5.0 mOhms: ----------Stable
   b. +5.1 to +10.0 mOhms: ----------Minor
   c. +10.1 to +15.0 mOhms:----------Acceptable
   d. +15.1 to +50.0 mOhms:----------Marginal
   e. +50.1 to +1000 mOhms: ----------Unstable
   f. >+1000 mOhms:----------Open Failure

	LLCR Measurement Summaries by Pin Type			
Date	7/28/2023	8/3/2023		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	54	54		
Technician	Peter Chen	Peter Chen		
mOhm values	Actual **Initial**	**Delta Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type: Signal 1			
Average	22.23	0.38		
St. Dev.	0.14	0.12		
Min	22.08	0.28		
Max	22.35	0.56		
Summary Count	4	4		
Total Count	4	4		
	Pin Type: GND 1			
Average	9.55	0.65		
St. Dev.	0.6	0.15		
Min	9	0.45		
Max	10.16	0.82		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
After 100 Cycles	8	0	0	0	0	0

DATA SUMMARIES Continued

LLCR Mating/Unmating Durability (00MJ-00BL):

1) A total of 4 signal and 4 ground points were measured.
2) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
3) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
4) The following guidelines are used to categorize the changes in LLCR as a result from stressing.
   a. <= +5.0 mOhms: ----------Stable
   b. +5.1 to +10.0 mOhms: ----------Minor
   c. +10.1 to +15.0 mOhms:----------Acceptable
   d. +15.1 to +50.0 mOhms:----------Marginal
   e. +50.1 to +1000 mOhms: ----------Unstable
   f. >+1000 mOhms:----------Open Failure

	LLCR Measurement Summaries by Pin Type			
Date	10/10/2023	10/11/2023		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	50	50		
Technician	Keney Chen	Keney Chen		
mOhm values	Actual **Initial**	**Delta Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type: Signal 1			
Average	21.74	0.31		
St. Dev.	0.28	0.20		
Min	21.42	0.06		
Max	22.08	0.48		
Summary Count	4	4		
Total Count	4	4		
	Pin Type: GND 1			
Average	9.66	0.48		
St. Dev.	0.18	0.26		
Min	9.43	0.19		
Max	9.86	0.81		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
After 500 Cycles	8	0	0	0	0	0

DATA SUMMARIES Continued

LLCR Mating/Unmating Durability (00MJ-00BS):

1) A total of 4 signal and 4 ground points were measured.
2) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
3) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
4) The following guidelines are used to categorize the changes in LLCR as a result from stressing.
   a. <= +5.0 mOhms: ----------Stable
   b. +5.1 to +10.0 mOhms: ----------Minor
   c. +10.1 to +15.0 mOhms:----------Acceptable
   d. +15.1 to +50.0 mOhms:----------Marginal
   e. +50.1 to +1000 mOhms: ----------Unstable
   f. >+1000 mOhms:----------Open Failure

	LLCR Measurement Summaries by Pin Type			
Date	10/10/2023	10/19/2023		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	50	50		
Technician	Keney Chen	Keney Chen		
mOhm values	Actual **Initial**	**Delta Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type: Signal 1			
Average	22.20	0.19		
St. Dev.	0.25	0.24		
Min	22.03	0.04		
Max	22.57	0.55		
Summary Count	4	4		
Total Count	4	4		
	Pin Type: GND 1			
Average	9.73	0.27		
St. Dev.	0.28	0.19		
Min	9.34	0.05		
Max	10.02	0.46		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
After 1000 Cycles	8	0	0	0	0	0

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: HZ-TCT-01
Description: Normal force analyzer
Manufacturer: Mecmesin Multitester
Model: Mecmesin Multitester 2.5-i
Serial #: 08-1049-04
Accuracy: Last Cal: 3/4/2023, Next Cal: 3/3/2024

Equipment #: HZ-MO-05
Description: Micro-ohmmeter
Manufacturer: Keithley
Model: 3706
Serial #: 1285188
Accuracy: Last Cal: 12/17/2023, Next Cal: 12/16/2024

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 08/21/2023, Next Cal: 08/21/2024

Equipment #: ACLM-01
Description: Accelerometer
Manufacturer: PCB Piezotronics
Model: 352C03
Serial #: 115819
Accuracy: See Manual
… Last Cal: 07/09/2023, Next Cal: 07/09/2024