



Industrial M12 D-Code to RJ45 Plug Cordsets

1. Scope

1.1 Contents

This specification covers the requirements for product performance, test methods and quality assurance provisions of M12 D-Code 4P to RJ45 Plug Cordsets product.

2. Applicable Documents :

The following documents form a part of this specification to the extent specified herein. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1 TE Specifications:

- 114-106140: Application Specification (M12 X-code series application specification)
- 501-137541: Qualification Test Report For P/N: TCDX47XXX1-XXX

2.2 Commercial Standards and Specifications:

- IEC 61076-2-101: Detail specification for M12 connectors with screw-locking
- IEC 60512: Electromechanical Components For Electronic Equipment; Basic Testing Procedure and Measuring Methods
- IEC-60529: Degree of Protection Provided by Enclosures(IP Code)
- IEC/ISO 11801-1 Channel performance according Class D - Table 5
- IEC 60603-7-3: Connectors for electronic equipment-Detail specification for 8 way, shielded, free and fixed connectors, for the data transmission with frequencies up to 100Mhz

3. Requirements:

3.1 Design and Construction:

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

3.2 Materials:

Material used in the construction of this product should be as specified on the applicable product drawing.

3.3 Ratings:

3.3.1 Electrical

- A. Voltage Rating : 30 Volts for 4 position product
- B. Current Rating: 0.5A Max;
- C. Temperature Rating:
-25° C to 60° C for cable assembly

PRELIMINARY



PRODUCT SPECIFICATION

108-137541
18 APR 2021 Rev. A

3.3.2 Environmental

Sealing Requirements: M12 D Code side IP67
RJ45 Plug side IP20

Durability: 100 cycles

3.4 Performance Requirements and Test Descriptions :

The product shall be designed to meet the electrical, mechanical and environmental performance requirements specified in Fig 1.

All tests shall be performed at the ambient environmental conditions per IEC 512, unless otherwise specified.

3.5 Test Requirements and Procedures Summary

3.5.1.1 For M12 D code connector side

Para	Test Items	Requirements	Procedures
1.1	Examination of product	No defect would impair normal operation	Visual inspection No physical damage. IEC 60512, Test 1a
Electrical Requirements			
2.1	Voltage proof (withstanding voltage)	1 minute hold with no breakdown or flashover.	1400 volts AC or DC Max, hold for 1 minute between adjacent contacts/ between contacts and shield IEC 60512-4-1
2.2	Insulation Resistance	100MΩMin.	500V DC between adjacent contacts IEC 60512, Test 3a, Method A
2.3	LLCR	Initial value: 10mΩ max. Final: Δ15mΩ max.	Subject specimens to 100 milliamps maximum and 20 millivolts maximum open circuit voltage Test points refer to Fig.5 IEC 60512-2-1, Test 2a
2.4	Temperature Rising	30° C MAX under loaded rating current. (See fig.3)	Stabilize at rate current level until 3 readings at 5 minutes intervals are within 1°C Current rating: 4A for 22 AWG cable 3A for 24 AWG cable IEC 60512-5-2
Mechanical Requirements			
3.1	Impacting water	No ingress of water	IEC 60529, Test 14.2.7
3.2	Dust (IP67)	No deposit dust on contact	IEC 60529, Test 6



PRODUCT SPECIFICATION

108-137541
18 APR 2021 Rev. A

3.3	Durability	Contact resistance: $\Delta 15m\Omega$ max.	Mate and un-mate specimens for cycles at a maximum speed of operations=10mm/s, Rest:30s,unmated 100 cycles for gold plating EIA364-09-1
3.4	Mating/Un-mating Force	15N/15N Max. for 2-5 pins	Operation speed: 10mm/min. Measure force necessary to mate samples. EIA364-13
3.5	Sinusoidal vibration	1: Duration of disturbance 1 μ s max. 2: Contact resistance: $\Delta 15m\Omega$ max. 3:There shall be no defect that would impair normal operation	10Hz to 500Hz and 0.35mm or 50 m/s ² Sweep cycles:10 Full duration:6H IEC60512, Test 6d
3.6	Mechanical Shock	1:No discontinuities of 1 microsecond or longer duration 2: Contact resistance: $\Delta 15m\Omega$ max. 3:There shall be no defect that would impair normal operation	Subject mated specimens to 50G's half-sine shock pulses of 11 milliseconds duration with 3.44m/s velocity change. Three shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks. EIA364-27
Environmental Requirements			
4.1	Rapid change in temperature	See Note.	IEC 60512-11-4 Subject specimens to 5 cycles between -25 °C to 85°C with 30 minutes dwells at temperature extremes Refer to 3.3.1.C : Temperature Rating
4.2	Dry heat	See Note. Insulation resistance at high temperature	IEC 50512-11-9 Subject mated specimens to 85°C for 16 hours
4.3	Damp heat, cyclic	See Note.	IEC 60512-11-12 Subject specimens to 5 cycles(5 days) Temperature:40°C Recovery time:2h
4.4	Cold	See Note.	IEC 60512-11 Temp.: -25°C Duration:2h Recovery time:2h Refer to 3.3.1.C : Temperature Rating
4.5	Mixed flowing gas	See Note.	IEC 60068-2-60, Method 4 Subject mated specimens to flowing mixed gas corrosion-4 days



PRODUCT SPECIFICATION

108-137541
18 APR 2021 Rev. A

NOTE Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Re qualification Test Sequence shown in Figure 2.

Fig. 1 (END)

3.5.1.2 Electrical transmission requirements (For M12 D code to RJ45 plug cordsets)

Requirements: The results were compared to the limit lines specified in the ISO/IEC 11801-1 for category CAT5E Channel level performance

Test Group	CAT5E - Channel Requirements
Insertion Loss	Channel performance according to IEC/ISO 11801-1 – Class D - Table 5. ≥4dB at 1 MHz, ≥24dB at 100MHz
Return Loss	Channel performance according to IEC/ISO 11801-1 – Class D – Table 3 ≥17dB at 1 MHz, ≥10dB at 100MHz
Near End Crosstalk (NEXT)	Channel performance according to IEC/ISO 11801-1 – Class D - Table 7. ≥ 63.3 dB at 1 MHz, ≥ 30.1 dB at 100 MHz

3.5.1.3 Product Qualification Test Sequence

Test or Examination	Test Group					
	A(a)	B	C	D	E(f)	F(g)
	Test Sequence					
Examination of product	1	3,6,11,20,26	8	9	1	1
Voltage proof	4	10,19,25	4,7	4,8		
Insulation resistance	3	9,13,18,24	3,6	3,7		
LLCR	2	2,5,8,17,23	2	2	2,6	
Temperature Rising				5(e)		
Impacting water		21	5	6		
Dust(IP6X)		22(b)				
Durability					4	
Mating and Un-mating Force					3,5	
Sinusoidal vibration		1				
Mechanical shock		4				
Rapid change in temperature		7		1		
Dry heat		12				
Damp heat, cyclic		14(c),16(d)				
Cold		15				
Mixed flowing gas			1			
Transmission requirement						2



PRODUCT SPECIFICATION

108-137541
18 APR 2021 Rev. A

NOTE:

- (a) When the initial test group A has been completed, the specimens are divided in the 3 groups B, C, D. All connectors in each group shall undergo the tests specified for the relevant group numbers indicate sequence in which tests are performed.
- (b) It's allowed to perform with an additional specimen, extending the total number of specimen by 1.
- (c) First cycle
- (d) Remaining cycles
- (e) Test with additional specimen for over-molding type cable assembly
- (f) This test group should be tested without the screw nut
- (g) This group samples should use M12 D code to RJ45 plug cordsets products

End Fig.2

3.5.2 For RJ45 Plug side

General			
No.	Test Items	Requirements	Condition according to
1.1	Visual and dimensional examination	Meets requirements of product drawing, No defect would impair normal operation	Visual inspection No physical damage. IEC 60512, Test 1a
Electrical Requirements			
2.1	Contact Resistance	Initial	Measure at to 20mV open circuit at 100mA maximum. see figure 6 IEC 60512-2-1, Test 2a
		Final	
2.2	Insulation Resistance	1000MΩMin.See Figure 5	IEC 60512-3-1, Method A 500V±15V DC between adjacent contacts, 1 minute hold
2.3	Voltage proof (withstanding voltage)	1 minute hold with no breakdown or flashover.	IEC 60512-4-1 1000 volts AC at sea level. Test between adjacent contacts of mated plug and jack.

Mechanical Requirements			
3.1	Vibration, jack-plug interface.	No discontinuities of 1 microsecond maximum. Shall remain mated and show no evidence of physical damage.	Subject mated specimens to 50 G's half-sine shock pulsed of 11 milliseconds duration. Three shocks in each direction applied along 3 mutually perpendicular planes, 18 total shock. Discontinuity less than 1μs, No damage.



PRODUCT SPECIFICATION

108-137541
18 APR 2021 Rev. A

3.2	Mechanical shock, jack-plug interface.	No discontinuities of 1 microseconds maximum. No damage.	Subject mated specimens to 3.10G's rms between 20~500Hz. 15 minutes in each of 3 mutually perpendicular planes. Discontinuity less than 1 μ s, No damage.
3.3	Durability, jack-plug interface.	Δ R 10 milliohms maximum. No physical damage.	IEC 60512-9-1. Mate and unmated plug and jack interface with latch inoperative for 1000 cycles at a maximum rate of 500 (automatic) per hour.
3.4	Plug withdrawal force, jack-plug interface	30N MAX.(Shielded)	IEC 60512-13-1. Measure force required to unmated plug and jack with latch depressed at a maximum rate of 0.5 inch(1.27mm) inch per minute. plug and jack with latch depressed at a maximum rate of 0.5 inch(1.27mm) inch per minute.
3.5	Plug retention in jack, jack-plug interface.	Plug shall not dislodge from jack.	EIA 364-98. Apply an axial load of 50N or 90N to plug housing at a rate of 1.27mm per minute with plug mated in jack and latch engaged. Maintain load for 60 seconds.

Environmental Requirements

4.1	Thermal shock	Δ R 10 milliohms maximum. No physical damage.	IEC 60512-11-9. Subject mated plug and terminated jack to 25 cycles between -40°C and 70° C.
4.2	Humidity / temperature cycling	Δ R 10 milliohms maximum. No physical damage.	IEC 60068-2-38. Subject mated plug and terminated jack to 21 cycles (cycle time 24 hours) between 25 and 65°C at 95% RH with a -10°C sub-cycle shock.
4.4	Humidity, steady state	Δ R 10 milliohms maximum. No physical damage.	IEC 60512-11-12. Subject mated plug and terminated jack to 55°C (PC) or 85°C (TR55) and 95% RH for 10 days.
4.5	Stress relaxation	Δ R 10 milliohms maximum. No physical damage.	IEC 60068-2-2, Test Method Ba. Subject mated plug and terminated



PRODUCT SPECIFICATION

108-137541
18 APR 2021 Rev. A

			jack to 70° C (PC), or 85°C (TR55) for 500 hours.
4.6	Salt Spray Test	1) ΔR 10 milliohms maximum. 2) 10 times under the magnifying glass to observe the coating without peeling, cracks wrinkling, separation and other phenomena, allowing up to one terminal has a corrosion point, the area does not exceed 5%	Temperature: 35 ± 2 ° C, humidity: 100% RH, NaCl concentration: 5%

Fig. 3

3.5.3 RJ45 Plug side Product Qualification and Requalification Test Sequence

No.	Test or Examination	Test Group						
		A	B	C	D	E	F	G
		Test Sequence						
1	Examination of product	1	1,5	1	1,5,10	1,5,10	1,9	1,5
2	Contact resistance	2	2,4		2,6	2,6	2,4	2,4
3	Insulation resistance	3			7	7	5	
4	Voltage proof	4			8	8	6	
5	Durability, jack-plug interface	5	3		9		7	
6	Plug insertion force, jack-plug interface			2				
7	Plug withdrawal force, jack-plug interface			3				
8	Plug retention in jack, jack-plug interface			4		9	8	
9	Thermal shock				3	3		
10	Humidity/temperature cycling					4		
11	Humidity, steady state				4			
12	Salt Spray Test							3
13	Stress relaxation						3	

Fig. 4

4. QUALITY ASSURANCE PROVISIONS

4.1 Qualification Testing

A. Specimen Selection

Plugs and receptacles should be prepared in accordance with applicable Instruction Sheet and should be elected at random from current production. Each test group shall consist of 3 specimens Min. unless otherwise stated.

B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in figure 2.

4.2 Requalification testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process or controlling industry specification, product assurance, shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.3 Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmitted.

4.4 Quality conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

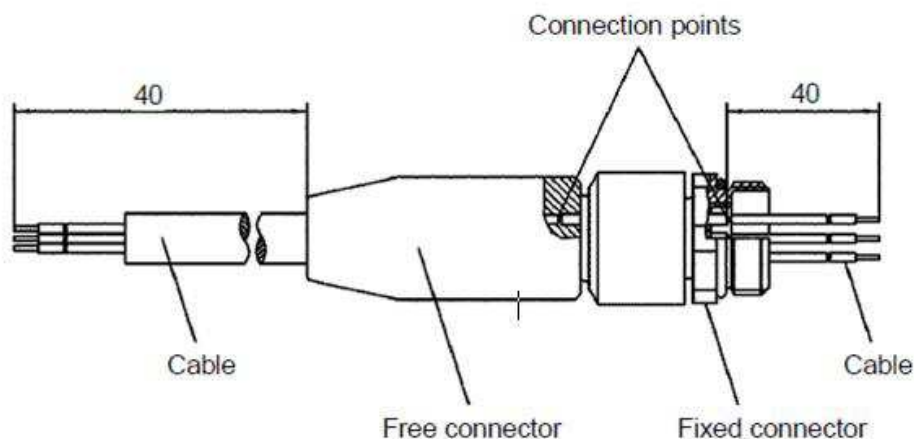
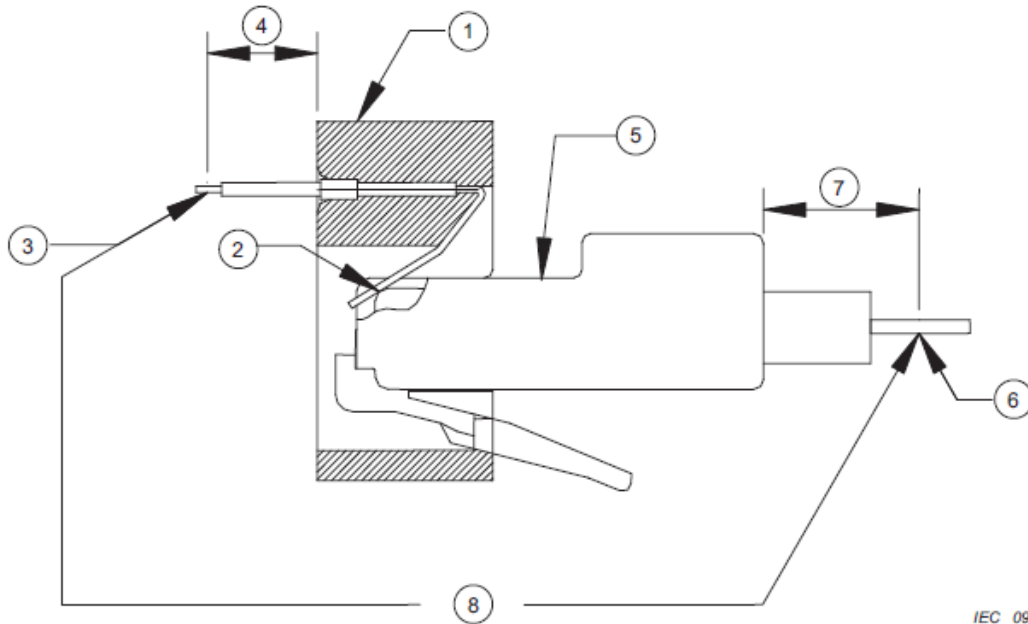


Fig.5 Contact resistance arrangement



IEC 09805

Key

- 1 Fixed connector.
- 2 Point B.
- 3 Point A.
- 4 As short as practical (except for vibration test CP2, see 7.3).
- 5 Free connector.
- 6 Point C.
- 7 As short as practical (except for vibration test CP2, see 7.3).
- 8 Contact resistance measurement points.

Figure 6