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**Industrial M12 X-code Circular Connector**

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**1. SCOPE**

## 1.1. Content

This specification defines performance, tests and quality requirements for the M12 X-code connector

## 1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

## 1.3. Qualification Test Results

Successful qualification testing on the subject product line has been completed on June 17 2014. The Qualification Test Report number for this testing is 501-137008.

**2. APPLICABLE DOCUMENTS AND FORMS**

The following documents and forms constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document applies.

## 2.1. TE Documents

- [114-137008](#): Application Specification (M12 X-code application specification)
- [501-137008](#): Qualification Test Report (M12 X-code test report)

## 2.2. Industry Documents

- IEC 61076-2-109: Detail specification for M12 X-code connectors
- IEC 60512: Electromechanical Components For Electronic Equipment; Basic Testing Procedure and Measuring Methods
- IEC-60529: Degree of Protection Provided by Enclosures(IP Code)

## 2.3. Reference Document

- [109-197](#): Test Specification (TE Test Specification vs EIA and IEC Test Methods)
- IEC 61076-2-101: Connectors for use in DC.low-frequency analogue and digital high speed data applications-Part 2: Circular connectors with assessed quality-Sectional specification
- ISO 1302: Geometrical Product Specifications (GPS)-Indication of surface texture in technical production documentation

**3. REQUIREMENTS**

## 3.1. Design and Construction

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

## 3.2. Ratings

- Rated voltage: 48 volts for 8 position product
- Current-carrying capacity:  
8 pole (0.25mm<sup>2</sup> wire gauge) = 0.5A (single contact 1A)
- Contact resistance <5 mΩ
- Insulation Resistance>10<sup>8</sup>Ω
- Temperature Rating : -25° C to +85° C

### 3.3. Environmental

IP67 according to IEC 60529 connectors in mated and locked position.

### 3.4. Test Requirements and Procedures Summary

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

Test Description	Requirement	Procedure
Initial examination of product.	Meets requirements of product drawing and Application Specification	IEC 60512, Test 1a Visual and dimensional (C of C) inspection per product drawing.
<b>ELECTRICAL</b>		
Low Level Contact Resistance(LLCR)	Initial value: 5mΩ maximum Final value: Δ10Ωmaximum	IEC 60512-2-1, Test 2a Subject specimens to 100 milliamperes maximum and 20 millivolts maximum open circuit voltage
Insulation Resistance	100MΩMin.See Figure 3	IEC 60512-3-1, Method A 500V±15V DC between adjacent contacts, 1 minute hold
Voltage proof (withstanding voltage)	1 minute hold with no breakdown or flashover.	IEC 60512-4-1 Ramp at 500 volts per second maximum All contact connected together to shield.
Electrical load and temperature	See note	IEC60512, Test 9b Duration: 1000h Amp. Temp: 40°C Current load:0.5A, single contact Recovery time:2 h Temperature: sensor in center of specimen
<b>MECHANICAL</b>		
Sinusoidal vibration	No electrical discontinuity greater than 1μs See Figure 4	IEC 60512, Test 6d 10Hz to 500Hz and 0.35mm or 5g Sweep cycles:10 Full duration:6H
Mechanical Shock	No electrical discontinuity greater than 1μs	IEC 60512, Test 6c Half sine shock acceleration 490m/s <sup>2</sup> (50g) Duration of impact:11ms
Durability	See note	IEC 60512, Test 9a Max speed of operations= 10 mm/s Rest:30s, unmated For gold contact finish, Mate and unmated specimens for 50 cycles.
Tensile strength (Crimped connection)	15N Min.	IEC 60512, Test 16d According to IEC 60352-2
<b>ENVIRONMENTAL</b>		

Test Description	Requirement	Procedure
Rapid change in temperature (30 minutes dwells at temperature extremes)	See note.	IEC 60512 test 11d Subject specimens to 5 cycles between -25 and 85°C with 30 minute at temperature extremes.
Rapid change in temperature (60 minutes dwells at temperature extremes)	See note.	IEC 60512 test 11d Subject specimens to 5 cycles between -25 and 85°C with 60 minute at temperature extremes.
Damp heat, cycle, first cycle	See note	IEC 60512-11-12 Method dB Subject specimens to 5 cycles (5 days) between 40 and 55°C at 90 to 100% RH
Damp heat, remaining cycle	See note	IEC 60512-11-12 Method dB Subject specimens to 5 cycles (5 days) between 40 and 55°C at 90 to 100% RH
Dry heat	See note	IEC 60512-11-9 Temperature:85°C Duration : 16 hours
Max flowing gas	See note	IEC 60512-11-7 test method 4 Flowing mixed gas – 4 days, according 60068-2-60
Impacting water(IPX7)	No ingress of water	IEC 60529, Test 14.2.7
Cold	There shall be no defect that would impair normal operation	IEC 60512-11 Temperature:-25°C Duration : 2h Recovery time:2h



**NOTE**

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

**3.5. ELECTRICAL TRANSMISSION REQUIREMENTS**

Insertion loss	Mated connectors Mated connectors all pairs: $\leq 0.02 \sqrt{f}$ db from 1 to 500MHz, whenever the formula results in a value less than 0.1 db, the requirement shall revert to 0.1db	IEC60512-27-100 Test 27a
NEXT loss	Mated connectors All pair combinations: $\geq 94-20\log(f)$ dB from 1MHz to 250MHz All pair combinations: $\geq 46.04-30\log(f/250)$ dB from 250 to 500MHz	IEC 60512-27-100 Test 27c
Return loss	Mated connectors All pairs: $\geq 68-20\log(f)$ dB from 1 MHz to 500MHz. whenever the formula results in a value greater than 30db, the requirement shall revert to 30db	IEC 60512-27-100 Test 27b
FEXT loss	Mated connectors All pair combinations: $\geq 83.1-20\log(f)$ dB from 1MHz to 500MHz whenever the formula results in a value greater than 75db, the requirement shall revert to 75db	IEC 60512-27-100 Test 27d



**NOTE**

- A. Electrical transmission tests are applicable for connector for symmetrical pair cabling. The measurements shall be performed according to the contact and pair designation in figure 3.
- B. Category 6A transmission performance interoperability shall be demonstrated by testing the female connectors with full range of male connectors in the style of IEC 60512-27-100 and IEC 60512-25-9. Transmission performance and backward compatibility shall be demonstrated by testing the female connectors with range of male connectors or “test plugs” described in IEC 60512-26-100. All transmission performance requirements apply between the reference lanes specified in IEC 60512-27-100.
- C. f is the frequency expressed in MHz in above table.

3.6. Product Qualification and Requalification Test Sequence

Test Examination	Test Group (a)				
	1	2	3	4	5
	Test Sequence (b)				
Examination of product	1,21	1,13	1,14	1	
Voltage proof(withstanding voltage)	4,11,19	4,12	4,8,13		
Insulation resistance	3,10,13,18	3,11	3,7,12		
LLCR	2,7,9,17	2,6,8,10	2,6,11		
Impacting water(IPX7)	20				
Durability 50cycles		5,9	9		
Sinusoidal vibration	5				
Mechanical shock	6				
Rapid change in temperature (30 minutes dwells at temperature extremes)	8				
Rapid change in temperature (60 minutes dwells at temperature extremes)			5		
Dry heat	12				
Damp heat, cyclic, first cycle	14				
Damp heat, cyclic, remaining cycles	16				
Cold	15				
Mixed flowing gas		7			
Electrical load and temperature			10		
Tensile strength(crimped connection)				2	
Transmission requirement					1



**NOTE**

- (a) Test groups 1-3 shall have 3 samples each test group 4 shall have 5 and group 5 shall have 2.
- (b) Numbers indicate sequence in which tests are performed.
- (c) Test group 5 is according to Electrical transmission requirements table.

End Figure 2

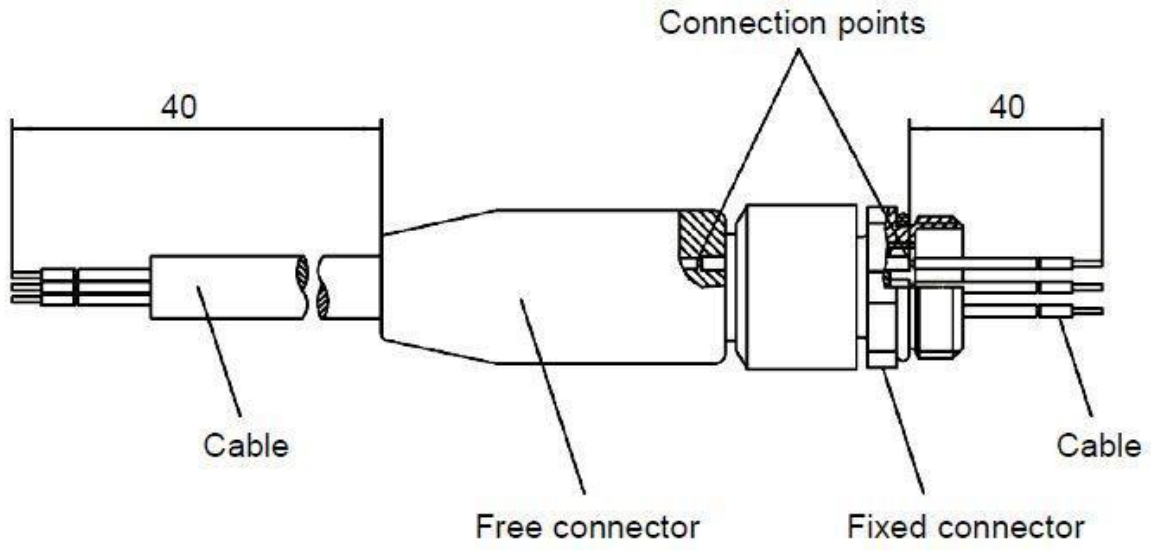
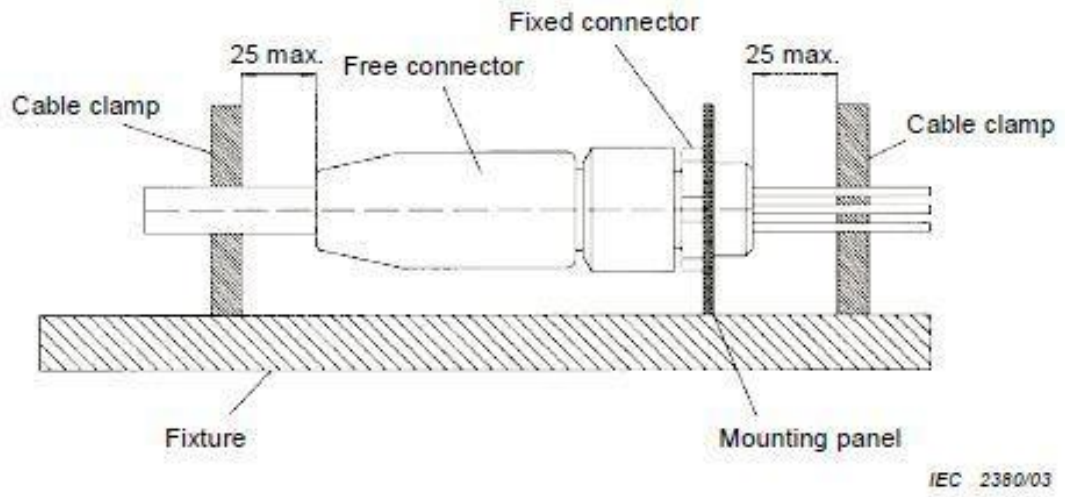
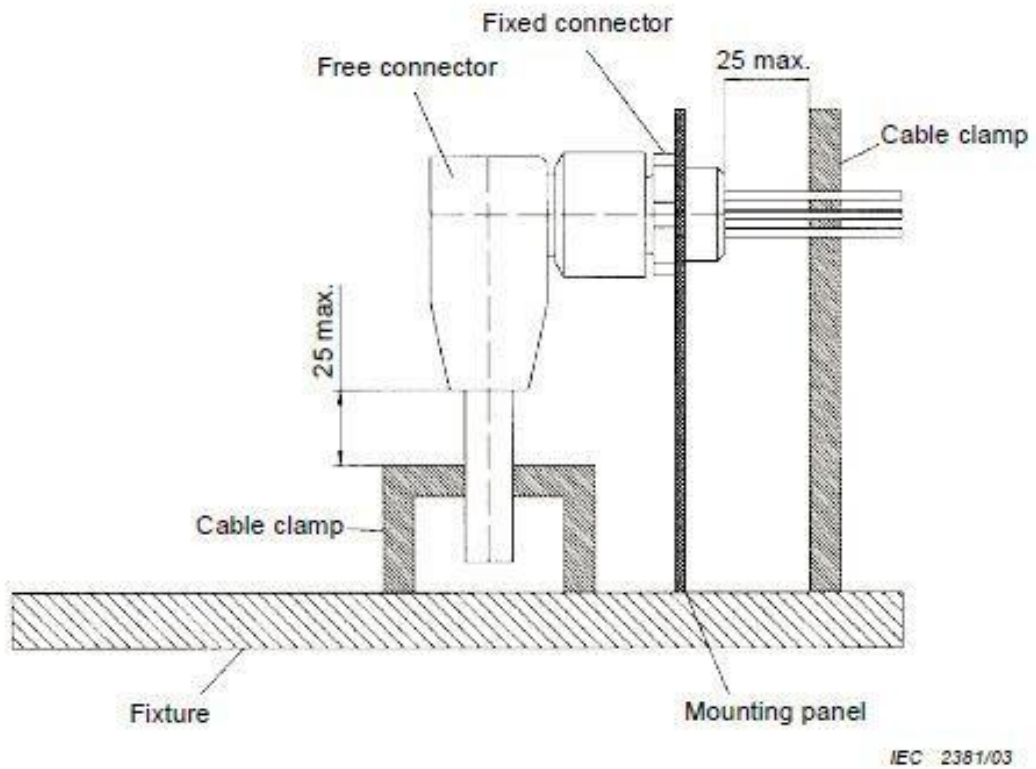


Figure 3- Contact resistance arrangement



IEC 2380/03



IEC 2381/03

Figure 4- Dynamic stress test arrangement