

NMEA2000 Micro Connector Product Specification



1. Scope / 概論

A leading professional solutions provider of waterproof connectors (overmolded with cable, receptacle, field installable) in the industry, Amphenol LTW (ALTW) always fulfills any requirements with high functionality and reliability products; even it is a very special requirement. And it is highly recommended to be applied to harsh environment.

Amphenol LTW (ALTW) 是防水連接器計設及生產的領導者,主要包含線端,板端及現場組裝式連接器以滿足各種使用求及特殊要求,產品具有高效能及高可靠性,非常適合在各種惡劣的環境條件下提供安裝及使用。

This product specification sheet describes the product application in the markets such as Renewable Energy, Industrial

Automation, LED Lighting, Marine, Broadband Wireless Access, Smart Grid, Heavy Equipment, Medical, Electrical Vehicle....etc.

本規範主要描述了 Amphenol LTW(ALTW)產品的應用要求。 本產品廣泛應用於可再生能源，工業自動化，LED，船舶，寬帶無線接入，智能電網，建築機械/重型車輛，醫療設備等，電動車行業....

2. Applicable Documents / 參考文件

2.1 Industry Document / 業界標準

Amphenol LTW (ALTW) 設計及生產的產品符合各項世界標準,包括 IEC, EIA, MIL, NMEA....

3. Specification / 規格

3.1 Material / 材質

Parts / 零件	Material / 材質
Connector / 連接器	Thermoplastic / 熱塑性塑膠
Pin / 端子	Copper Alloy / 銅合金
Nut / 螺帽	Thermoplastic / 熱塑性塑膠, Metal / 金屬
Clamp Ring / 夾環	Thermoplastic / 熱塑性塑膠
O-Ring / O 型環	Rubber / 橡膠
Gasket / 墊圈	
Seal / 密封圈	
Shield/Shell / 屏蔽	Metal / 金屬

3.2 Rating / 操作評級

Voltage / 電壓	60V D.C./A.C. 60 伏 直流/交流
Current / 電流	3A
Operating Temperature / 操作溫度	Receptacle: -40°C to +85°C (攝氏-40 度~85 度) Overmolded With Cable / Receptacle With Wires : -20~80°C (攝氏-20 度~80 度) Field Installable : -40°C~105°C (攝氏-40 度~105 度)
IP / 防水等級	Overmolded With Cable : IP67, IP68 (1M / 24h) Receptacle / Receptacle With Wires : IP67, IP68 (1M / 24h) Field Installable : IP67

4. Test Requirement/測試要求

4.1 Appearance/外觀

Item / 項目	Test Condition / 測試條件	Requirement / 條件需求
Examination of product 外觀檢查	EIA-364-18 Visual inspection No physical damage 檢查外觀是否有損壞	No defect would impair normal operation 沒有缺陷會影響正常操作

4.2 NMEA2000 Test to be Conducted /NMEA2000 測試項目

Item / 項目	Test Condition / 測試條件	Requirement / 條件需求																																		
Physical Configuration-Connector 物理結構	<p>NMEA 2000 Appendix I, Section 6.21 ODVA Specification, Edition 1.5, Section 8-3.12.4 Table 8-3.70 (Micro Connector) NMEA2000 附錄 I，第 6.21 章節 依照 ODVA 規範版本 1.5,第 8-3.12.4 章節，表 8-3.70(Micro Connector)</p> <table border="1"> <thead> <tr> <th>Male General Characteristics</th> <th>Specification</th> </tr> </thead> <tbody> <tr><td>Number of Pins</td><td>5</td></tr> <tr><td>Coupling Nut</td><td>Male</td></tr> <tr><td>Coupling Nut Thread</td><td>M12 x 1 6G fit</td></tr> <tr><td>Rotation¹</td><td>Optional</td></tr> <tr><td>Standard</td><td>IEC 60947-5-2, Figure D.2 intermateability requirements</td></tr> <tr><td>Pinout</td><td>Drain : Pin 1, V+ : Pin 2, V- : Pin 3, CAN_H : Pin 4, CAN_L : Pin 5</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Female General Characteristics</th> <th>Specification</th> </tr> </thead> <tbody> <tr><td>Number of Sockets</td><td>5</td></tr> <tr><td>Coupling Nut</td><td>Female</td></tr> <tr><td>Coupling Nut Thread</td><td>M12 x 1 6G fit</td></tr> <tr><td>Rotation¹</td><td>Required</td></tr> <tr><td>Standard</td><td>IEC 60947-5-2, Figure D.2 intermateability requirements</td></tr> <tr><td>Pinout</td><td>Drain : Pin 1, V+ : Pin 2, V- : Pin 3, CAN_H : Pin 4, CAN_L : Pin 5</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Physical Characteristics</th> <th>Specification</th> </tr> </thead> <tbody> <tr><td>Wiping Contact Plating Requirements</td><td>30 micro inch gold minimum over 50 micro inch nickel minimum or 5 micro inch gold minimum over 20 micro inch palladium-nickel minimum over 50 micro inch nickel. All gold must be 24 Karat</td></tr> <tr><td>Wiping Contact Life</td><td>1000 insertion-extractions.</td></tr> </tbody> </table>	Male General Characteristics	Specification	Number of Pins	5	Coupling Nut	Male	Coupling Nut Thread	M12 x 1 6G fit	Rotation ¹	Optional	Standard	IEC 60947-5-2, Figure D.2 intermateability requirements	Pinout	Drain : Pin 1, V+ : Pin 2, V- : Pin 3, CAN_H : Pin 4, CAN_L : Pin 5	Female General Characteristics	Specification	Number of Sockets	5	Coupling Nut	Female	Coupling Nut Thread	M12 x 1 6G fit	Rotation ¹	Required	Standard	IEC 60947-5-2, Figure D.2 intermateability requirements	Pinout	Drain : Pin 1, V+ : Pin 2, V- : Pin 3, CAN_H : Pin 4, CAN_L : Pin 5	Physical Characteristics	Specification	Wiping Contact Plating Requirements	30 micro inch gold minimum over 50 micro inch nickel minimum or 5 micro inch gold minimum over 20 micro inch palladium-nickel minimum over 50 micro inch nickel. All gold must be 24 Karat	Wiping Contact Life	1000 insertion-extractions.	<p>Visually inspect that the connectors male and female ends have same physical configuration as per the Open DeviceNet Vendor Association Specification, Edition 1.5 根據 ODVA 協會規範 1.5 版，目視檢查連接器公端和母端是否具有相同的物理結構</p> <p>60947-5-2 © IEC:1997+A1:1999+A2:2003 - 181 -</p> <p>NOTE: The central pin may be omitted when not necessary.</p> <p>Figure D.2 - M12 Ø 5-pin integral connector for d.c. proximity switches</p>
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Connector Electrical Characteristics 電氣性能	<p>NMEA 2000 Appendix I, Section 6.23 Visually inspect that the connectors meets the specification as per the following section of the Open DeviceNet Vendor Association Specification, Edition 1.5 Section 8-3.12.4 Table 8-3.70 (Micro Connector) NMEA2000 附錄 I，第 6.23 章節 參考 ODVA 規範 Edition 1.5, 章節 8-3.12.4，Table 8-3.70 (Micro Connector)</p> <table border="1"> <thead> <tr> <th>Electrical Characteristics</th> <th>Specification</th> </tr> </thead> <tbody> <tr><td>Operating Voltage</td><td>25 volt minimum</td></tr> <tr><td>Contact Rating</td><td>3 amps minimum</td></tr> <tr><td>Contact Resistance</td><td>Nominal: Less than 1 mOhm. Maximum: 5 mOhms over life.</td></tr> </tbody> </table>	Electrical Characteristics	Specification	Operating Voltage	25 volt minimum	Contact Rating	3 amps minimum	Contact Resistance	Nominal: Less than 1 mOhm. Maximum: 5 mOhms over life.	<ul style="list-style-type: none"> all gold pins must be 24 Karat The contact rating for the micro connector must be 3 amp minimum 鍍金純度必須為 24Karat 連接器端子額定電流至少 3 安培 																										
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<p>Connector Water Resistance 連接器防水性能</p>	<p>NMEA 2000 Appendix I, Section 6.24</p> <p>Visually inspect that the connectors meets the specification as per the following section of the Open DeviceNet Vendor Association Specification, Edition 1.5</p> <p>Section 8-3.12.4 Table 8-3.70 (Micro Connector)</p> <p>NMEA2000 附錄 I，第 6.24 章節</p> <p>參考 ODVA 規範 Edition 1.5， 章節 8-3.12.4， Table 8-3.70 (Micro Connector)</p>	<ul style="list-style-type: none"> • The IP rating must be a minimum of IP67 • 連接器防水等級需高于 IP67
<p>Connector Oil Resistance 連接器耐油性</p>	<p>NMEA 2000 Appendix I, Section 6.25</p> <p>UL1277, OIL RES II, 60 Days in IRM 902 Oil at 75°C (See Figure 1)</p> <p>NMEA2000 附錄 I，第 6.25 章節</p> <p>依據標準 UL1277, OIL RES II, 在溫度為 75°C 的 IRM 902 油中浸泡 60 天(參考圖 1)</p>	<ul style="list-style-type: none"> • There shall be no visible external indications of damage or of unwanted ingress of oil. • 不應有任何明顯的外部損壞跡象或不希望的油進入至連接器內部
<p>Connector Pull Strength/Separation 拉力</p>	<p>NMEA 2000 Appendix I, Section 6.26</p> <p>參考 NMEA2000 標準附錄 I，第 6.26 章節</p>	<ul style="list-style-type: none"> • Verify that the connector meets or exceed the pull strength of 65lbs when attached to the cable. • 連接器拉力強度需大于 65lbs
<p>Termination Resistors 終端电阻</p>	<p>NMEA 2000 Appendix I, Section 5.3 and Section 6.28</p> <p>參考 NMEA2000 標準附錄 I，第 5.3 章節及第 6.28 章節</p>	<ul style="list-style-type: none"> • Verify that the termination resistors meet or exceed the requirements as specified in Section 8-3.2 of the Open DeviceNet Vendor Association Specification, Edition 1.5 • 檢查電阻是否符合要求
<p>Dust Test 防塵測試</p>	<p>Clause 13.4 of IEC 60529, Edition 2.2, IP6X</p> <p>Sample condition: non-operating & mated with fixture</p> <p>Type of dust: Talcum powder</p> <p>The amount of dust: 2kg per cubic meter of the chamber volume</p> <p>The maximum depression: <20 mbar</p> <p>Test duration: 8 hours</p> <p>IEC60529, 2.2 版，第 13.4 條款，IP6X</p> <p>測試樣品為非工作狀態固定于夾具，試驗粉塵類型：滑石粉；粉塵量：2 公斤/立方米；最大下壓小于 20mbar；測試時間為 8 小時</p>	<ul style="list-style-type: none"> • Talcum powder did not enter the enclosure (IP6X rating) • 滑石粉未進入外殼(符合 IP6X 等級)
<p>Temporary Immersion Test (1m, 30 min) IPX7 防水</p>	<p>IEC 60529, IPX7: Should be immersed in water at depth of at least 1 m for 30 minutes.</p> <p>浸入深度至少 1 米的水中 30 分鐘。</p>	<ul style="list-style-type: none"> • Water did not enter the enclosure. • No physical damages • Visual inspection inside no water • 目視水不能侵入外殼 • 無物理損害； • 目視內部無水侵入
<p>Temporary Immersion Test (1m, 24 Hr) IPX8 防水</p>	<p>IEC 60529, IPX8: should be immersed in water at depth of at least 1 m for 24 hours.</p> <p>浸入深度至少 1 米的水中 24 小時。</p>	<ul style="list-style-type: none"> • Water did not enter the enclosure. • No physical damages • Visual inspection inside no water • 目視水不能侵入外殼 • 無物理損害； • 目視內部無水侵入

4.3 Electrical/電氣

Item / 項目	Test Condition / 測試條件	Requirement / 條件需求
Contact Resistance 接觸阻抗	EIA-364-23 Mate connectors and measured by dry circuit, 20mV 10mA maximum. 參考 EIA-364-23，公母對插的狀況下，使用 20mV MAX., 10mA.進行量測	initial : 1 mΩ maximum After test: Δ<5 mΩ maximum 初始值: 1 mΩ maximum 功能測試后: Δ<5 mΩ maximum
Dielectric Withstanding Voltage 耐電壓試驗	EIA 364-20 or IEC 60512-4-1 AC 1000 voltage for 1 minute, 給予固定 AC 1000V，測試 1 分鐘	<ul style="list-style-type: none"> • Current leakage less than 5mA • No physical damage, flashover, sparks, breakdown • 漏電流小于 5mA • 無物理損害,飛弧,跳火,擊穿
Insulation Resistance 絕緣電阻	EIA 364-21 Supply DC 500 voltage±10% for 2 minutes. 給予固定 DC500V±10%, 2 分鐘	The Insulation Resistant should be more than 100MΩ 絕緣阻抗須達 100MΩ以上

4.4 Mechanical/機械

Item / 項目	Test Condition / 測試條件	Requirement / 條件需求
Wiping Contact Life Test 耐久性	Test method reference EIA-364-09, at rated cycling of 500±50 per hour 參考 EIA-364-09 進行測試，插拔速率為每小時插拔 500±50 次	1000 cycles minimum, no physical damage; Pass the sequenced tests 插拔壽命最小 1000 次, 無物理損害; 符合群組測試
Mating force and Un-mating force 插拔力	EIA-364-13, The connectors shall then be fully mated at a rate of 25.4 millimeters/minute 連接器插拔速率為 25.4mm/分鐘	<ul style="list-style-type: none"> • Mating Force: 10N(1.02kgf) maximum • Un-mating Force: 15N(1.53kgf) maximum • 插入力: 最大 10N(1.02kgf) • 拔出力: 最大 15N(1.53kgf)

4.5 Environmental/環境

Item / 項目	Test Condition / 測試條件	Requirement / 條件需求
Cyclic Humidity 溫度循環濕性測試	EIA-364-31, RH : 90~95%, Temperature : -20~+85°C for 96 hours, 24 hours per cycle 濕度 90~95% , 溫度-20~+85°C , 共 4 天(96 小時)。	<ul style="list-style-type: none"> • Visual Examination • Electrical Performance test • 目視檢查 • 電氣性能檢查

Table 12.2
Oil resistance of jackets

Condition of specimens at time of measurement	Minimum ultimate elongation (1-inch or 25-mm bench marks)	Minimum tensile strength
Unaged	In accordance with requirements in UL 1581 from Table 12.1	
Specimens of 75°C (167°F) oil-resistant jacket from cable marked "oil resistant II"[see 29.1(i)]: Aged in IRM 902 oil for 60 d at 75.0 ±1.0°C (167.0 ±1.8°F)	65 percent of the result with unaged specimens	65 percent of the result with unaged specimens
Specimens of 60°C (140°F) oil-resistant jacket from cable marked "oil-resistant I" [see 29.1(j)]: Aged in IRM 902 oil for 96 h at 100.0 ±1.0°C (212.0 ±1.8°F)	50 percent of the result with unaged specimens	50 percent of the result with unaged specimens

Figure 1 ---UL1277 Table 12.2

NMEA2000 Test to be Conducted:

(#) – Code for Tests Conducted.
1. Physical Configuration-Connector:
2. Plating Requirements-Connector:
3. Connector Electrical Characteristics
4. Connector Water Resistance:
5. Connector Oil Resistance:
6. Connector Pull Strength/Separation:
7. Termination Resistors:
8. Dust Test
9. Temporary Immersion Test (1m, 24 Hr)
10. Temporary Immersion Test (1m, 30 min)

Product type	Tests Conducted
Adapter	1-5, 8, 9 (Group A,B,C,E,H,I)
Panel Mount connector	
Terminator	1-5, 7, 8, 9 (Group A,B,C,E,G,H,I)
Cable Assembly	1-6, 8, 9 (Group A,B,C,E,F,H,I)
Field Attachable Connector	1-6, 8, 10 (Group A,B,C,D,E,F,H)

5. Product Qualification Test Sequence/測試群組及順序

	Test or Examination	Test Group										
		A	B	C	D	E	F	G	H	I	J(*)	K(*)
		Test Sequence										
Appearance	Examination of product 外觀檢查	1	1	1	1	1	1	1	1	1	1, 6	1, 9
NMEA2000 Test Conducted	Physical Configuration-Connector 物理結構	2										
	Plating Requirements-Connector 電鍍要求		2									
	Connector Electrical Characteristics 電氣性能			2								
	Connector Water Resistance 連接器防水性能				3				3	3		
	Connector Oil Resistance 連接器耐油性					2						
	Connector Pull Strength/Separation 拉力						2					
	Termination Resistors 終端电阻							2				
	Dust Test 防塵測試								2			
	Temporary Immersion Test (1m, 30 min) IPX7 防水				2							
	Temporary Immersion Test (1m, 24 Hr) IPX8 防水									2		4, 6
Electrical	Contact Resistance 接觸阻抗										2, 5	
	Dielectric Withstanding Voltage 耐電壓試驗											2, 7
	Insulation Resistance 絕緣電阻											3, 8
Mechanical	Wiping Contact Life Test 耐久性										4	
	Mating force and Un-mating force 插拔力										3	
Environmental	Cyclic Humidity 溫度循環濕性測試											5

Notes:

(*): Group J & Group K for Panel Mount connector、Adapter、Cable Assembly、Field Attachable Connector; Terminator do not to be test.

6. Others/其他

6.1 Torque/扭力

Panel Nut (Receptacle) / 鎖板 (板端)	4~6 kgf.cm
Mating Nut (Overmolded With Cable/Field Installable) / 對插 (線端/組裝式)	4~6 kg.cm
Clamp Ring/ 接管 (組裝式)	4~6 kg.cm
Sealing Nut / 尾蓋 (組裝式)	4~6 kg.cm
Screw of the Screw-in type / 鎖芯線螺絲 (組裝式)	0.61~0.84 kg.cm
Nut plate screw 鎖附壓板	10~12 kg.cm

7. Quality Assurance Provisions/品質保證

Unless otherwise specified, in the contract or purchase order, we will be responsible for the quality of the part as it is delivered to client. We will be responsible for having controlled processes to ensure product is in total compliance with this specification. Failing lots shall be subject to return or other corrective action.

除非在合同或採購訂單中另有規定者外，我們將對交付給客戶的部件質量負責。我們將負責控制流程，以確保產品完全符合規格。未通過的批次應退回或採取其他糾正措施。

Re-qualification Testing : 重新資格測試

If changes significantly affecting form, fit or function are made to the product or manufacturing process, 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.

如果對產品或製造過程產生顯著影響的形狀，配合或功能的變化，產品保證應協調重新認證測試，包括由開發/產品，質量和可靠性工程確定的全部或部分的原始測試順序。

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