

Sensor M12 K/L/S/T Code 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 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) 是防水連接器設計及生產的領導者, 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	
Gasket / 墊圈	Rubber / 橡膠
Seal / 密封圈	
Shield/Shell / 屏蔽	Metal / 金屬

3.2 Rating / 操作評級

	K / L / S / T Coding					
	Rated voltage – Rated impulse voltage					
	Coding	Style	No. of contacts	Function	Rated voltage V	Rated impulse voltage kV
Voltage 電壓	K	5 way (4 + PE)	3	2 + PE	630 (690)	6
			4	3 + PE		
			5	4 + PE		
	L	5 way	3	2 + FE	63	1.5
			4	3 + FE		
			5	4 + FE		
		4 way	2	2		
			3	3		
			4	4		
	S	4 way (3 + PE)	3	2 + PE	630 (690)	6
			4	3 + PE		
	T	4 way	2	2	63	1.5
			3	3		
			4	4		
	Current 電流	Coding	No. of contacts 端子數		Rated current 電流(A)	
K		3~5		12 & 16		
L		3~5		16		
		2~4				
S		3~4		12		
T		2~4		12		
Temperature Range 溫度範圍	Overmolded With Cable / Receptacle With Wires : -25°C~85°C (攝氏-25度~85度)					
	Receptacle / Field Installable : -40°C~105°C (攝氏-40度~105度)					
 IP 防水等級	Insert (SMT/THR): -55°C ~ 125°C (攝氏-55度~125度)  					
	Overmolded With Cable : IP67 (Mated, 1M /30min) / IP68 (Mated, 1M / 24h)					
Receptacle / Receptacle With Wires : IP67 (Unmated, 1M /30min)/ IP68 (Unmated, 1M /24h) / IP68 (Mated, 1M / 24h) / IP69K (Mated) 						
Field Installable : IP67 (Mated, 1M /30min) / IP68 (Mated, 1M / 24h)						

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	IEC 60512, Test 1a 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 Electrical/電氣

Item / 項目	Test Condition / 測試條件	Requirement / 條件需求
Dielectric Withstanding Voltage 耐電壓試驗	IEC 60512, Test 5a, Method A Standard atmospheric conditions, Mated connectors 標準大氣條件,對接連接器	See table A-1
Contact Resistance 接觸阻抗	IEC 60512, Test 2a Standard atmospheric conditions connecting points 標準大氣壓力下測試接觸點	•10 mΩ max. •10 mΩ 最大
Insulation Resistance 絕緣阻抗	IEC 60512, Test 3a, Method A Standard atmospheric conditions Test voltage 500 V ± 15 V d.c. 標準大氣壓力下使用 500 V ± 15 V d.c.測試	•100MΩ min. •100MΩ 最小
Temperature Rise 溫升試驗	UL1977 section 16.1, Mated connector carry the maximum rated current (table) continuously for 4 hour and measure the temperature rise of contact.UL1977 第 16.1 節 · 配合連接器連續輸入最大額定電流 (附件) 4 小時 · 測量接觸溫升。	•Temperature rise Δt is no more than Relative Thermal Index of the insulating material •溫升 Δt 不大於絕緣材料的相對熱指數
	UL 2238 section 25, Mated connector carry the maximum rated current (table) continuously for 4 hour and measure the temperature rise of contact. 連接器對接後 · 額定電流(附件)持續輸入 4 小時 · 測量接觸點溫升。	•UL : The temperature do not exceed the RTI of insulating material. •CUL : Temperature rise Δt is no more than 30°C , also for CUL (CSA C22.2 No. 182.3,Clause 6.5) •UL: 溫度不超過絕緣材料的 RTI •CUL: 溫度升高 Δt 不超過 30°C

D Table A-1

Voltage proof



kV r.m.s.

Coding	No. of contacts	Earth Conductor contact	Between contacts		Between contacts and metal-housing	
			Fixed connectors	Free connectors	Fixed connectors	Free connectors
K	3	PE	3.31 *	3.31 *	3.31 *	3.31 *
	4					
	5					
L	3	FE	0.84	0.84	0.84	0.84
	4					
	5					
	2	Without				
	3					
	4					
S	3	PE	3.31 *	3.31 *	3.31 *	3.31 *
	4					
T	2	Without	0.84	0.84	0.84	0.84
	3					
	4					


* K code and S code

For 690V, Voltage proof 3.55KV based on UL2237.

4.3 Mechanical/機械

Item / 項目	Test Condition / 測試條件	Requirement / 條件需求
<p>Durability 耐久性</p>	<p>IEC 60512, Test 9a Standard atmospheric conditions, Max. speed of operations = 10 mm/s, Rest:30s,unmated 最大插拔速率10mm/s, 分離狀態下停留30s</p>	<ul style="list-style-type: none"> • No physical damage • 100 cycles for gold plating • 50 cycles for silver plating • 20 cycles for tin plating • 無物理損害 • 鍍金需至少滿足 100 次插拔 • 鍍銀需至少滿足 50 次插拔 • 鍍錫需至少滿足 20 次插拔
<p>Insertion Force and Withdrawal force Test 插拔力</p>	<p>IEC 60512, Test 13b Standard atmospheric conditions, Max. speed of operations = 10 mm/s, 標準大氣壓下測試, 最大插拔速度為10mm/s</p>	<p>成品對插 · 無對鎖動作</p> <ul style="list-style-type: none"> • Total insertion force <ul style="list-style-type: none"> 2~4 poles : 30N maximum 5~6 poles : 45N maximum • Total withdrawal force <ul style="list-style-type: none"> 2~4 poles : 30N maximum 5~6 poles : 45N maximum • 插入力: <ul style="list-style-type: none"> 2~4 poles : 30N 最大 5~6 poles : 45N 最大 • 拔出力: <ul style="list-style-type: none"> 2~4 poles : 30N 最大 5~6 poles : 45N 最大
<p>Vibration 震動試驗</p>	<p>IEC 60512, Test 6d 10~500Hz, and 0.35mm or 50m/s², sweep cycle: 10 cycle on each of the 3 axes, full duration: 6 h 頻率 : 10~500Hz, 掃描周期: 每軸向做 10 個循環測試 · 3 個軸向均需 測 · 持續時間 : 6 小時 </p>	<ul style="list-style-type: none"> • No physical damages • No electrical discontinuity more than 1μsecond. • 無物理損害 • 電氣訊斷不超過 1μ second
<p>Mechanical Shock 物理沖擊</p>	<p>Conditions: IEC 60512-6-3, test 6c, acceleration 500 m/s². The fixed and free connector shall be rigidly installed in a suitable fixture as specified in 7.1.4. Shock severity: 11 ms, half-sine wave, 3 shocks in each axis and direction of axes, total 18 shocks. 半正弦衝擊加速度 500m/s², 持續時間 : 11 ms </p>	<ul style="list-style-type: none"> •No physical damages •No electrical discontinuity more than 1μ second. •無物理損害 •電氣訊斷不超過 1μ second

4.4 Environmental/環境

Item / 項目	Test Condition / 測試條件	Requirement / 條件需求
<p>Waterproof Test</p> <p>防水測試</p>	<p>IIEC 60529, IPX7</p> <p>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> <p>IEC 60529, IPX8</p> <p>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> <p>DIN 40050-9, IPX9K</p> <p>protection against high pressure/steam jet cleaning</p> <p>防止高壓/蒸汽噴射清潔</p> 	<ul style="list-style-type: none"> •No physical damages •Visual inspection inside no water •Insulation resistance: 100MΩ min. •無物理損壞 •目視內部無水侵入 •絕緣電阻：100MΩ 最小
<p>Rapid change of temperature</p> <p>溫度變化</p>	<p>IEC 60512-11d</p> <p>-25 °C to 85 °C, t = 30 min, 5 cycles</p> <p>-25 °C to 85 °C, 時間 30 min, 5 個循環</p>	<ul style="list-style-type: none"> •No physical damages •無物理損壞
<p>Salt Spray</p> <p>鹽水噴霧試驗</p>	<p>IEC 60068-2-11</p> <p>5% salt solution for 48 hours.</p> <p>5% 鹽水溶液持續 48 小時。</p>	<p>No physical damages and meets sequenced tests.</p> <p>無物理損壞</p>

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

	Test or Examination	Test Group						
		A	B	C	D	E	F	G
Examination of product	Visual Examination	1,9	1,9	1,7	1,7	1,3	1,9	1,3
Electrical 電氣	Contact Resistance	2,6	2,6		2,6			
	insulation Resistance	3,7	3,7	2,6			2,7	
	Dielectric Withstanding Voltage	4,8	4,8	3,5			3,8	
	Temperature Rise Test					2		
Mechanical 機械	Insertion Force and Withdrawal force Test				3,5			
	Durability				4			
	Vibration Test	5						
	Mechanical Shock		5					
Environmental 環境	Rapid change of temperature			4			5	
	Salt Spray							2
	Waterproof Test						4,6	

6. Others/其他

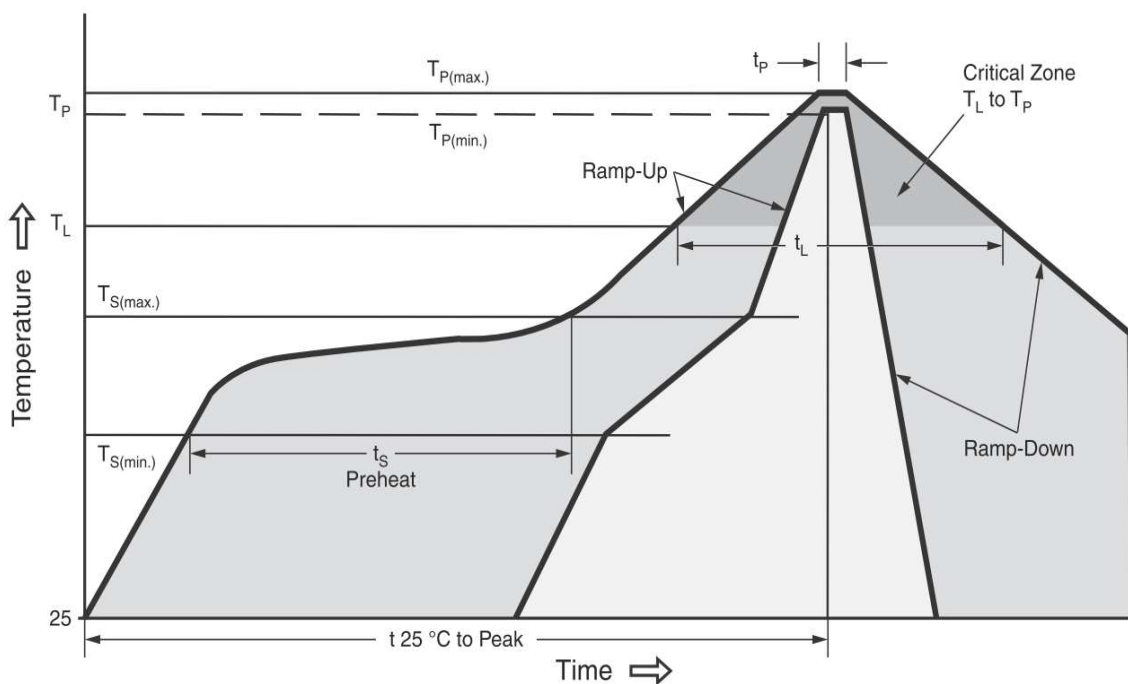
6.1 Torque/扭力

Panel Nut / 鎖板 (板端)	5~8 kgf.cm
Mating Nut (Overmolded With Cable/Field Installable) / 對插 (線端/組裝式)	5~8 kgf.cm
Clamp Ring / 接管 (組裝式)	8 kgf.cm (Min.)
Sealing Nut / 尾蓋 (組裝式)	6~8 kgf.cm
Screw of the Screw-in type / 鎖芯線螺絲 (組裝式)	0.84~1.5kgf.cm

D 6.2 Recommended Reflow Soldering Profile for SMT & THR / 建議 SMT 和 THR 回流焊溫度曲線

Refer to IPC_JEDEC J-STD-020		
Classification of Reflow Profile		
Profile Feature	Sn – Pb Eutectic Assembly	Lead (Pb)-Free Assembly (e.g. SnAgCu)
Average ramp-up rate ($T_{S(max.)}$ to T_P)	3 °C/s maximum	3 °C/s maximum
Preheat		
• Temperature minimum ($T_{S(min.)}$)	100°C	150°C
• Temperature maximum ($T_{S(max.)}$)	150°C	200°C
• Time ($T_{S(min.)}$ to $T_{S(max.)}$) (t_S)	60 s to 120 s	60 s to 180 s
Time maintained above		
• Temperature minimum (T_L)	183°C	217°C
• Time (T_L)	60 s to 150 s	60 s to 150 s
Minimum peak temperature ($T_{P(min.)}$)	215°C	235°C
Recommended peak temperature (T_P)	235°C	250°C
Maximum peak temperature ($T_{P(max.)}$)	260°C	260°C
Time within 5°C of actual peak temperature (t_P)	10 s to 40 s	20 s to 40 s
Ramp-down rate	6°C/s maximum	6°C/s maximum
Time 25°C to peak temperature	6 min maximum	8 min maximum

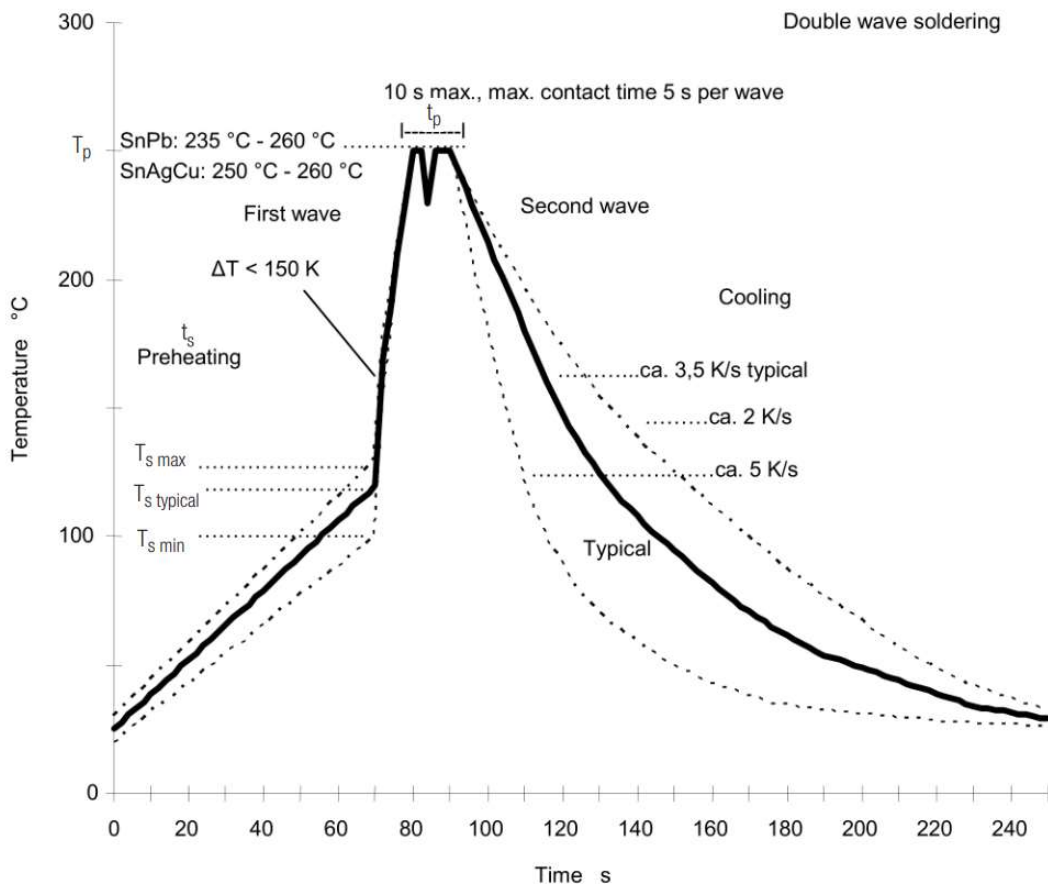
Reflow Soldering Profile



D 6.3 Recommended Wave Soldering Profile / 建議波峰焊溫度曲線

Refer to EN61760-1			
Classification Wave Soldering Profile			
Profile Feature		Pb-Free Assembly	Sn-Pb Assembly
Preheat Temperature Min	$T_{s \text{ min}}$	100°C	100°C
Preheat Temperature Typical	$T_{s \text{ typical}}$	120°C	120°C
Preheat Temperature Max	$T_{s \text{ max}}$	130°C	130°C
Preheat Time t_s from $T_{s \text{ min}}$ to $T_{s \text{ max}}$	t_s	70 seconds	70 seconds
Ramp-up Rate	ΔT	150°C max.	150°C max.
Peak temperature	T_p	250°C - 260°C	235°C - 260°C
Time of actual peak temperature	t_p	max. 10 seconds max. 5 seconds each wave	max. 10 seconds max. 5 seconds each wave
Ramp-down Rate, Min		~2 K / second	~2 K / second
Ramp-down Rate, Typical		~3.5 K / second	~3.5 K / second
Ramp-down Rate, Max		~5 K / second	~5 K / second
Time 25°C to 25°C		4 minutes	4 minutes

D Wave Soldering Profile



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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8. Revision/版本

Document Name		Sensor-M12 Series, KLST Code D		
Revision	ECN NO.	Description	Date	Sign
A		Initial Release	2021/05/14	Neo Tsai 蔡於潤
B		Operating Temperature 增加 Insert (SMT/DIP): -55°C ~ 125°C	2022/10/21	Alex Chiu 邱冠鈺
C		Updated IP rate	2023/03/16	Yunchen Lai 賴昀辰
D		Updated 3.2 Rating, 4.2 Electrical , 4.3 Mechanical, 6.1 Torque, 6.2 Recommended Reflow Soldering Profile, 6.3 Recommended Wave Soldering Profile	2024/10/11	Angel Chou 周梅琦

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