

# Amphenol RJ-Switch



## IP65/68 rugged Military Ethernet Unmanaged Switch - User Manual -

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Total Quality



Standard Locations



European Directives



US Emissions

This manual applies to the following products:

- **RJSXX-8US1-(704)-(PSM)-(DG90)-(CAPS)**  
Unmanaged IP68 Ethernet switch with 8 10/100 Mbps ports
- **RJSXX-8UG1-(ET)-(704)-(PSM)-(DG90)-(CAPS)**  
Unmanaged IP68 Ethernet switch with 8 Gigabit ports
- **RJSXX-8UG-PSM-2TV-CAPS**  
Unmanaged IP68 Ethernet switch with 8 Gigabit ports, powered with both DC and/or AC voltage

**Note:** **XX = ML:** Olive drab cadmium plating on both receptacles and enclosure  
**XX = BKN:** Black painted enclosure with nickel plated receptacles  
**XX = ML1019:** Sand painted enclosure with nickel plated receptacles  
**XX = BKN9010:** White painted enclosure with nickel plated receptacles  
**704 = option:** filter for power supply allowing better lightening protection  
**PSM = option:** 230VAC power supply  
**CAPS = option:** the switch comes with caps fixed onto each receptacle

### ***Amphenol Statement of Limited Warranty:***

The characteristics of the Products shall be defined as those published in the most recent version of the Vendor's specifications, unless different characteristics are expressly agreed between the Vendor and the Customer.

Unless expressly agreed to the contrary, the guarantee shall be valid for one year from the date of delivery.

The guarantee shall be made invalid:

- Where the cover of the switch enclosure have been opened.
- Where the components have been damaged in transit or have not been stored by the Customer in conditions in accordance with the specification.
- Where the components have been subjected to abuse (mechanical, electrical or thermal) on installation or on use and, in the case of slices/dice, have been subjected to handling or such operations as the welding of connecting wires mounting by soldering or sticking.
- Where the unfitness or defectiveness of the components has resulted from exceeding the maximum values for usage (temperature limit, maximum voltage, etc.) as defined by the Vendor, or from incorrect choice of application.

Furthermore, the guarantee shall not cover consequential liability, direct or indirect which may result from the failure of a component supplied by the Vendor.

The foregoing constitutes the Vendor's guarantee in its entirety and takes the place of any other format guarantee, implied or otherwise.

The guarantee is limited, at the Vendor's option, to either the replacement or the repair of the component accepted by him as being defective, to the exclusion of any other form of compensations.

### ***FCC Statement:***

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient or relocate the receiving antenna; Increase the separation between the equipment and receiver; Connect the equipment into an outlet on a circuit different from that to which the receiver is connected; Consult the dealer or an experienced radio/TV technician for help.

### ***Copyright & Trademarks:***

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**Note: All information in this document is subject to change without notice.**

## Section 1

## General Information

### Overview

This manual will help you install and maintain the **Amphenol Military Ethernet Unmanaged switches**. These products are extremely easy to install and operate because little or no user configuration is required. Once the Ethernet connections are made and the unit is powered up it will immediately begin to operate.

### Operation

Unlike an Ethernet hub that broadcasts all messages out all ports, these switches will intelligently route Ethernet messages only out the appropriate port. The major benefits of this are increased bandwidth and speed, reduction or elimination of message collisions, and deterministic performance when tied with Unmanaged systems.

The 8US switches support both 10BaseT (10 Mbps) and 100BaseTx (100 Mbps) on their RJ45 ports. The 8UG switches support also 1000BaseTx (1000 Mbps).

Each of these ports will independently auto-sense the speed, allowing you to interface to regular or fast Ethernet devices.

Refer to Section 6 for more information on operation and features.

### Performance Specifications

These general specifications apply to these switches. Refer to Section 7 for complete technical specifications.

Ports	10/100BaseT(x) or 10/100/1000BaseT(x) (Shielded RJ45)
Required Voltage	Models 8US1 & 8UG1-(ET): 12 - 48 VDC Models 8US1-704 & 8UG1-(ET)-704: 12 – 33 VDC Models 8US1-PSM & 8UG1-(ET)-PSM: single power input AC and DC AC voltage: 85-264 VAC / 47-63 Hz DC voltage: 120-370 VDC Model 8US1-PSM-2TV: dual power input AC and DC AC input: 85-264 VAC / 47-63 Hz DC input: 12 - 48 VDC
Ethernet Standards	IEEE 802.3 (10BaseT), 802.3u (100BaseTX), 802.3x (Full Duplex)
Ethernet Protocols	All standard IEEE 802.3 protocols supported
Speed Per Port	RJ45: 100 Mbps (half duplex) or 200 Mbps (full duplex)
Ethernet Isolation	1500 Volts RMS (for 1 minute)
Operating Temp.	Models 8US1: -40 to 70 °C Models 8UG1: -10 to 60°C Models 8UG1-ET: -40 to 70°C
Waterproof	IP68 (2 m water for 24 hours)
Shocks	MIL-STD-810F (40g)

### Standards and Safety



The Amphenol Military Ethernet Switch meets the following standards:

**Electrical safety** - UL 60950-1, CAN/CSA-C22.2 No.60950

**EMI /EMC**- FCC part 15, CISPR22, U.E. EN55011, EN61000-6-4; EN55022 Class A, EN61000-3-2/3, EN55024, IEC61000-4-2/3/4/5/6/8, EN61000-6-2

**Install the Amphenol Military Ethernet Switch in accordance with local and national electrical codes.**

**Lightning Danger: Do not work on equipment during periods of lightning activity.**

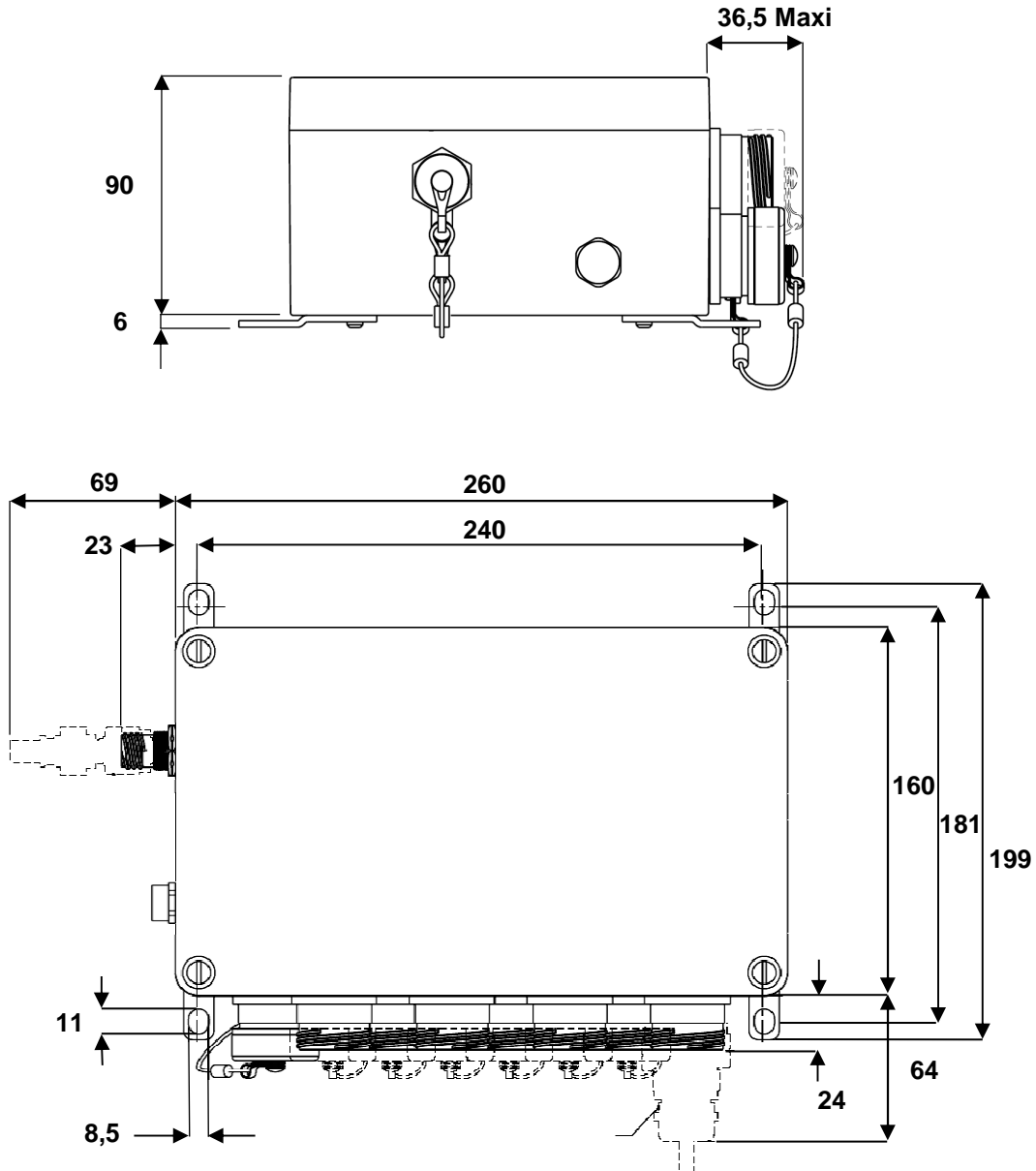
**Do not connect a telephone line into one of the Ethernet RJ45 connectors.**

## Section 2 Installation

### Overview

All switches share the same footprint and can be mounted directly to a flat surface or to a wall. Refer to the mechanical drawing below. Its high protected enclosure makes it able to withstand water jets (IP65 rating) but also immersion until 2m depth (IP68 rating).

The Ethernet connections for all models come out from rugged MIL-DTL-38999 III connectors from RJField range (see [www.rjfield.com](http://www.rjfield.com)). Make sure to allow enough room to route your Ethernet cables.



## Section 3

## Power Wiring

### Overview

These switches can be powered from the same DC or AC source that is used to power your I/O devices. Refer to the wiring diagram hereafter for correct voltage powering.

GND screw should be tied to panel or chassis ground.

### Plugs and backshells

The switches should be powered using mating plugs and backshells compliant with MIL-DTL-38999 series III. We suggest using hereunder accessories. Another backshell can be used but it must ensure a correct sealing protection.

#### Accessories part numbers



	RJS-ML-8US1-(704)-(PSM)-(CAPS) RJS-ML-8UG1-(ET)-(704)- (PSM)- (CAPS)	RJS-BKN-8US1-(704)-(PSM)-(CAPS) RJS-BKN-8UG1-(ET)-(704)- (PSM)- (CAPS)
Plug	TV 06 RW 0935 S (Size 9; using 6 contacts #22D)	TVS 06 RF 0935 S (Size 9; using 6 contacts #22D)
Backshell	TVNSA 09 014	TVNSA 09 023
Heat shrink	804221	804221

RJS-ML-8UG-PSM-2TV-CAPS		
	For DC power 12-48 VDC	For AC power 85-264 VAC
Plug	TV 06 RW 0998 S (Normal coding) (Size 9; using 3 contacts #20)	TV 06 RW 0998 S A (with A coding) (Size 9; using 3 contacts #20)
Backshell	TVNSA 09 014	TVNSA 09 014
Heat shrink	804221	804221


The plugs are using crimp contacts.

We suggest using hereunder tooling.

#### Crimping tools for all models

	Amphenol No	Military No
 Crimping tool	For #20: 809 857 For #22D: 809 801	For #20: M22520/1-01 For #22D: M22520/2-01
 Positioner	For #20: 809 858 For #22D: 809 835	For #20: M22520/1-04 For #22D: M22520/2-07

#### Plastic insertion and removal tools

Switch model	Contact size	Amphenol No	Military no	
8US1 & 8UG1 standards models	22D	809 856	M81969/14-01	
RJS-ML-8UG-PSM-2TV-CAPS	20	809 854	M81969/14-10	

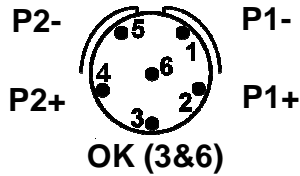
Note: metallic tools are also available. Consult dedicated Tri-Start TV-CTV catalog (E113) for details.

# Wiring power inputs

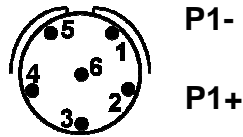
The diagrams below show the rear face of mating plugs.  
 The plugs to be used with the switches are from our TV series. They are compliant with MIL-DTL-38999 series III.  
 Part number of the power plug: See the previous page.



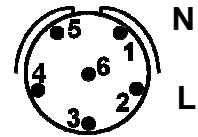
## Pinout for standard models 8US1 & 8UG1



Redundant Power Inputs for models 8US1 & 8UG1-(ET)  
 P1 and/or P2: 12-48 VDC

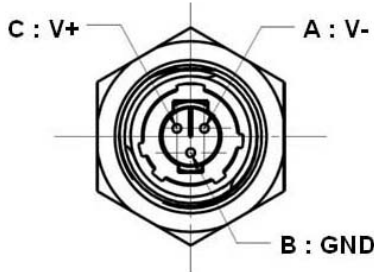


Single Power Input for models 8US1-704 & 8UG1-(ET)-704  
 P1: 12-33 VDC  
 3,4,5,6 : Not connected

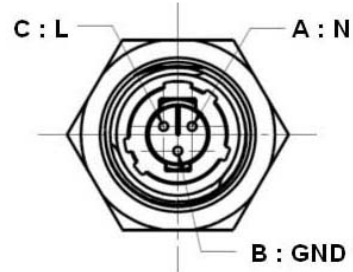


Single Power Input for models 8US1-PSM & 8UG1-(ET)-PSM  
 L: 85-264 VAC  
 3,4,5,6: Not connected

## Pinout for model RJS-ML-8UG-PSM-2TV-CAPS



For DC power 12-48 VDC



For AC power 85-264 VAC

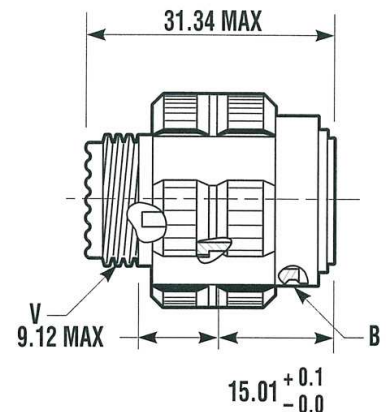
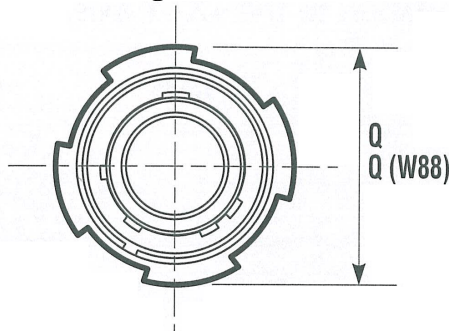
## Dimensions of acceptable wires

Switch model	Contact size	Gauge AWG / Section mm <sup>2</sup>		Outside diameter (mm)		
		min	max	Min	Average	Max
8US1 & 8UG1-(ET) standards models	22D	28 0.095	22 0.38	0.76	1.20	1.37
RJS-ML-8UG-PSM-2TV-CAPS	20	24 0.22	20 0.75	1.02	1.83	2.11

## Plugs dimensions

For all models:

Plug size: 9 (A)  
 B Thread Class 2A: 0.6250 mm  
 Q Max: 21.82 mm  
 V thread metric: M12x1-6g





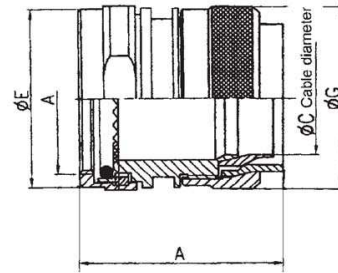
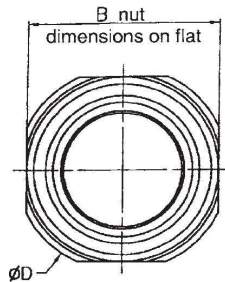
## Backshells

We suggest using TVNSA backshells with corresponding heat shrinks. See previous page for part numbers.

These backshells, providing an electrical continuity between cable and connector, ensure a high level of EMI/RFI protection. The sealing is ensured by straight heat shrink molded piece at the rear of the backshell. NSA and SA backshells ensure the shielding by clamping the braid with a screwing system. The free inner ring avoids twisting of the braid during screwing.

Heat-shrinks are molded pieces for harsh environment, fluid resistant (with preinstalled adhesive).

### TVNSA backshell dimensions



Switch model	Plug size	A length mm (in)	A thread Metric	B max mm (in)	C max mm (in)	Ø E max mm (in)	Ø G max mm (in)
All models	9 (A)	35.60 (1.402)	M12x1.0 -6H	16.70 (0.658)	6.90 (0.272)	15.62 (0.615)	16.50 (0.650)

### TVNSA backshell assembly instruction

1. Prepare the cable for termination process and slide onto the cable the items in the order shown on figure 1.

2. Screw the backshell at the rear of the connector.

3. Fold back the braid on the outer jacket and fix it (figure 2).

4. Install the braid as shown on figures 3 and 4:

Release the braid and cover the backshell (a) and the connector's shell. Slide the first ring (b) over the braid. Fold back the braid on the ring (b) and slide the second ring (c) over the braid and the first ring (b). Screw the last ring (d) at the rear of the backshell. If necessary, fix the extra braid on the outer jacket of the cable. If this installation (double folding of the braid) is not possible, refer to figure 5: Slide the first ring (b).

Release the braid and cover the backshell (a) and the connector's shell. Cut the braid as shown. Slide the second ring (c) over the braid and the first ring (b).

Screw the last ring at the rear of the backshell.

5. Install the heat-shrink molded piece.

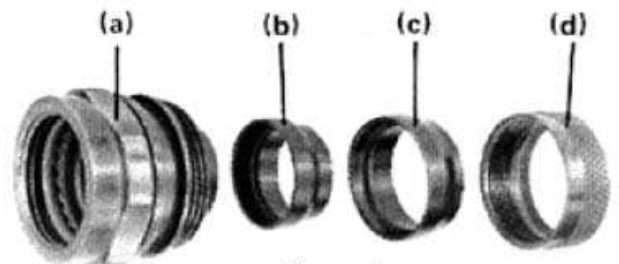


Figure 1

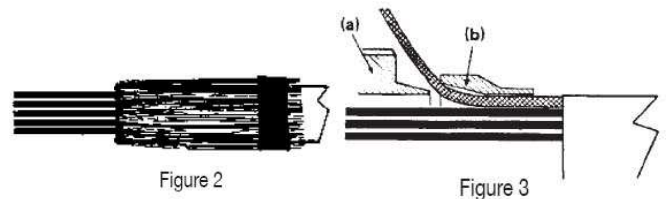


Figure 2

Figure 3



Figure 4

Figure 5

## Section 4

# Ethernet Wiring

### Overview

These switches provide connections to Ethernet devices on the battlefield. Typically a port is used to connect to another Ethernet switch or hub that is connected to the main Ethernet backbone. The other Ethernet ports are then connected to Ethernet devices such as communication systems, Ethernet I/O, or industrial computers. Electrical isolation is provided on the Ethernet ports for increased reliability.

Please follow normal Ethernet wiring practices when installing these switches.

### RJ45 Wiring Guidelines

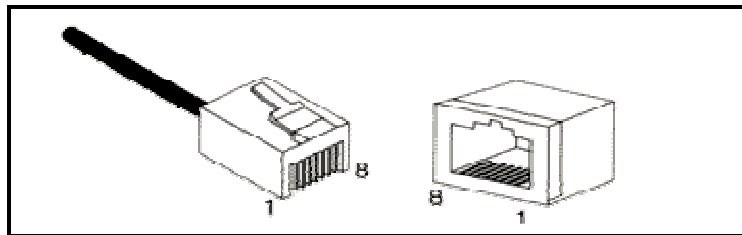
Use data-quality (not voice-quality) twisted pair cable rated category 5 (or better) with standard RJ45 connectors. You can use all standard existing RJ45 Cat5e cordset and transform it into an environmental connector, without any cabling operation, and without any tool!

Please note that these cables are available as straight-thru or cross-over configurations. Either type can be used because these switches support auto-mdi/mdix-crossover. For reference, the pin-outs of the two cable types are listed below.

### Ethernet Cable Pin-outs

Straight-thru Cable Wiring		Cross-over Cable Wiring	
Pin 1	Pin 1	Pin 1	Pin 3
Pin 2	Pin 2	Pin 2	Pin 6
Pin 3	Pin 3	Pin 3	Pin 1
Pin 6	Pin 6	Pin 6	Pin 2

### Ethernet Connector Pin Positions



### Ethernet Connector Pin-outs

Pin #	MDI-X Port	MDI Port (typical for uplink)	Auto-MDI/MDI-X	Ethernet Device Port
1	TX+	RX+	TX/RX+	RX+
2	TX-	RX-	TX/RX-	RX-
3	RX+	TX+	RX/TX+	TX+
6	RX-	TX-	RX/TX-	TX-

### Cable Distance

The maximum cable length for 10/100BaseT(x) is typically 100 meters (328 ft.).

From	To	Maximum Distance
Switch	Switch or Hub	100 meters (328 feet)
Switch or Hub	PLC, Ethernet I/O, PC, etc.	100 meters (328 feet)

**Note:** Hubs and switches are different devices. Hubs simply broadcast all messages out all ports. switches intelligently route messages only out the appropriate port.



## Ethernet IP68 plugs

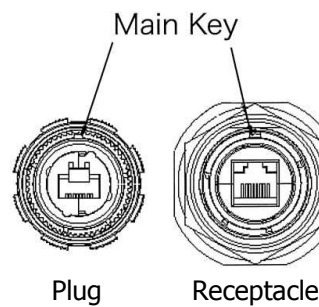
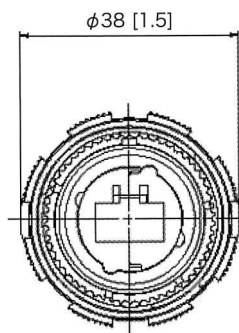
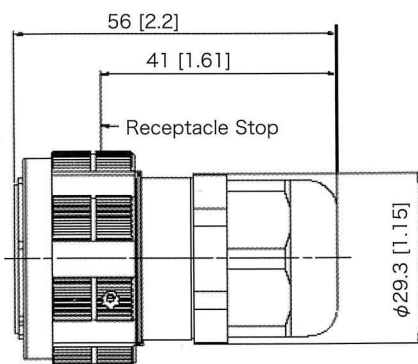
The IP68 rated RJ45 plug is field installable and does not require any special tools. It can be installed over any standard Ethernet patch cable (though you may have to remove the latch cover if it has an over-molded boot). Refer to the diagrams for mechanical and assembly details.

Part number of the plug to be used: **RJF TV 6 M G**. This plug may be assembled with 4 different coding. Use the coding A to make your assembly. For more details, please consult:

[http://www.rjfield.com/ethernet\\_connectors\\_rjf-tv\\_en.htm](http://www.rjfield.com/ethernet_connectors_rjf-tv_en.htm).



### RJFTV6MG plug dimensions and A coding

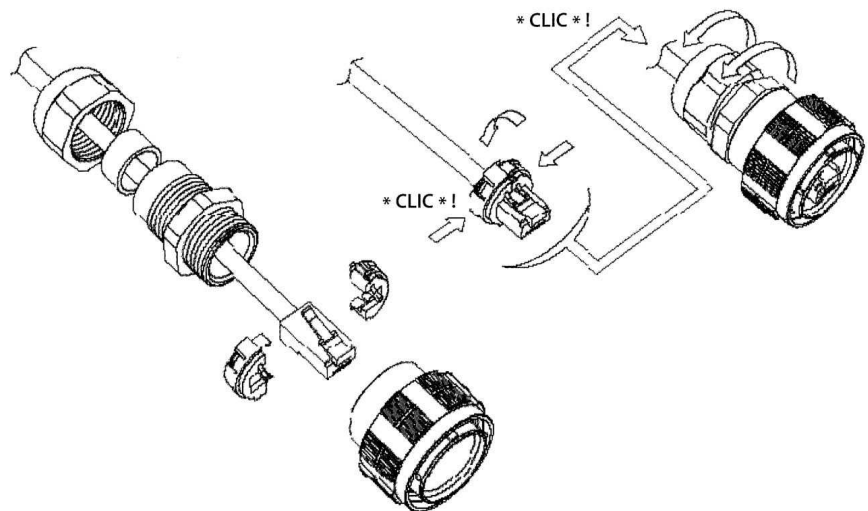


### Code A



### RJFTV6MG plug assembly instructions

- 1- Push down the RJ45 cordset latch, and fix it inside the insert.
- 2- Press in and click the other part of the insert.
- 3- Insert in the metallic housing. The RJ45 cordset latch should be at the same position than the main key of the shell to meet the A coding.



## CAPS for Ethernet ports

The models of switches with –CAPS (example: RJS-ML-8UG1-CAPS) termination are pre-equipped with caps on all ports, including power and Ethernet.

The models without –CAPS termination (example: RJS-ML-8UG1) do not have caps on ports. The required number of caps may be ordered separately as accessories.

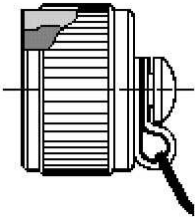
Part number of the caps as accessories:

**RJSML C 7 G** (with Olive drab Cadmium plating)

**RJSML C 7 N** (with Nickel plating)

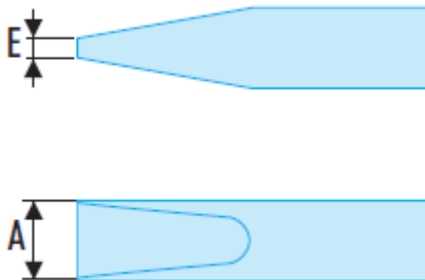
The cap can be screwed directly on the receptacle.

**Note:** The screw is supplied with the cap.



## Assembly of the cap

Tool: Use a flat screw-driver to assemble the cap onto the switch.



Suggested dimensions for the screwdriver:

- Thickness:  $E = 0.8 \text{ mm}$
- Width:  $A = 5\text{mm} \pm 1\text{mm}$

Suggested coupling torque: 1.2 N.m.

Here's a brief explanation of some of the features found in these switches documented by this manual.

#### **10BaseT, 100BaseTx or 1000BaseTx Auto-detection**

Standard Ethernet (10BaseT) has a maximum speed of 10 Mbps in half duplex mode. Fast Ethernet (100BaseTx) has a maximum speed of 200 Mbps in full duplex mode. The RJ45 ports on these switches automatically select the appropriate speed.

#### **Auto-crossover (auto-mdi/mdix)**

The RJ45 ports will automatically detect the cable type (straight-thru vs. cross-wired) and re-configure themselves accordingly.

#### **Auto-polarity**

The RJ45 ports will automatically correct for reversed polarity on the TD and RD pair.

#### **Auto-sensing or auto-negotiating speed**

The RJ45 ports of these switches will auto-negotiate with the connected device to determine the optimal speed (10 Mbps vs. 100 Mbps vs. 1000 Mbps).

#### **Flow control**

These switches automatically support flow control frames on both transmit and receive sides. Back-pressure flow control for half-duplex ports and pause-frame flow control for full-duplex ports.

#### **Forwarding**

These switches support store and forward mode. They will forward messages with known addresses out only the appropriate port. Messages with unknown addresses, broadcast messages, and multicast messages will get forwarded out all ports except the source port.

#### **Full / Half duplex operation**

The RJ45 ports of these switches support both full and half duplex flow control.

#### **IEEE 802.3 compliant**

The Amphenol Military Ethernet Switch strictly abides to the IEEE 802.3 standard for 10BaseT, 100BaseTX and 1000BaseTX Ethernet communications.

#### **Jumbo Frames**

The 8UG gigabit models support Jumbo frames up to 9kbytes.

#### **Plug and play**

This means that most functions or features of these switches are automatic and that there are minimal or no optional parameters that need to be set. Just plug in your Ethernet cables, apply power, and the unit will immediately begin to operate.

#### **Protocol independent**

These switches will work with all popular Ethernet protocols and networks such as TCP/IP, the Internet (IP), UDP, NetBEUI, and many more. It is compatible with all protocols that run over standard Ethernet (IEEE 802.3). In fact, it will support packets of different protocols simultaneously.

#### **Reverse polarity protection**

The standard models (except -PSM) are protected against voltage polarity inversion.

#### **Unmanaged operation**

These switches require no supervisory processor to operate properly.

## Section 6

## Technical Specifications

### Technical Specifications

Here are the technical specifications for these switches covered by this manual.

<b>Copper Ports</b>	
Shielded RJ45	10/100BaseT(x) ports for US models 10/100/1000BaseT(x) ports for UG models
Coupling mechanism	Star Thread (MIL-DTL-38999 series III type) with anti-decoupling device
RJ45 cordset retention	100 N in the axis of the plug
Mating cycles	500 min
Protocols supported	All standard IEEE 802.3
Ethernet compliancy	IEEE 802.3, 802.3u, 802.3x
Auto-crossover	Yes , Auto-mdi/mdix-crossover
Auto-negotiating	10BaseT, 100BaseTX or 1000BaseTX (8UG models)
Auto-polarity	Yes
Flow control	Half or full duplex
Ethernet isolation	1500 VRMS 1 minute
Plug and play	Yes
Cable requirements	Twisted pair (Cat. 5 or better) (shielded recommended)
Max. cable distance	100 meters
<b>General</b>	
Operation	Unmanaged, Store and forward
Compliance	IEEE 802.3 (10BaseT), 802.3u (100BaseTX), 802.3x (Flow Control)
Latency (typical)	5 µsec (time to route a message from one port to another internal to switch)
Address learning	Automatic
Address migration	Automatic
Buffers per port & buffer size	Automatic and dynamic
Illegal frames	Dropped per 802.3
Flow control	Yes, for half and full duplex
Jumbo frames	Supports Jumbo frame transmission up to 9kbytes (only 8UG models)
<b>Environmental</b>	
Required supply voltage	Depends on models: see section 1
Power consumption (typical)	5 Watts Max Note: Power consumption varies on speed and activity of each port.
Operating temp. range	Models 8UG1: -10°C to +60°C Models 8UG1-ET: -40°C to +70°C Models 8US1: -40°C to +70°C
Storage temp. range	-40 to 85 °C
Waterproof	IP68, 2m / 24h
Electrical safety	UL 60950-1, CAN/CSA-C22.2 No.60950
EMI / EMC	FCC part 15, CISPR22, U.E. EN55011, EN61000-6-4; EN55022 Class A, EN61000-3-2/3, EN55024, IEC61000-4-2/3/4/5/6/8, EN61000-6-2
Vibration	RTCA/DO-160C Sinusoidal vibrations 5-55 Hz: 0.01 inch ; 55-500 Hz: 1.5g
Altitude	MIL-STD-810F Altitude 50,000 ft – 15,000 m
Shocks	MIL-STD-810F (40g, 11ms, 18 saw tooth shocks)
Salt Spray	500 h (Olive Drab Cadmium)
Dimensions	See mechanical diagrams
Power filtering (option -704 only)	MIL-STD-461E CE102 Conducted Emission DEF-STAN-59-41 DCE01/ DCE02 DEF-STAN-61-5 Pt 6 MIL-STD-704A 600V Input transient, applied for 10µs MIL-STD-1275A Spikes: +/- 250 V for 100µs Surges: 100 V for 50 ms at 0.5 mohm Ripple: 14VAC pk - pk

## Section 7

## Service Information

### Service Information

We sincerely hope that you never experience a problem with any **Amphenol** product. If you do need service, call **Amphenol** at +33(0) 450 89 28 00 and ask for Applications Engineering. A trained specialist will help you to quickly determine the source of the problem. Many problems are easily resolved with a single phone call. If it is necessary to return a unit to us, an RMA (Return Material Authorization) number will be given to you.

**Amphenol** tracks the flow of returned material with our RMA system to ensure speedy service. You must include this RMA number on the outside of the box so that your return can be processed immediately.

The applications engineer you are speaking with will fill out an RMA request for you. If the unit has a serial number, we will not need detailed financial information. Otherwise, be sure to have your original purchase order number and date purchased available.

We suggest that you give us a repair purchase order number in case the repair is not covered under our warranty. You will not be billed if the repair is covered under warranty.

Please supply us with as many details about the problem as you can. The information you supply will be written on the RMA form and supplied to the repair department before your unit arrives. This helps us to provide you with the best service, in the fastest manner. Normally, repairs are completed in two days. Sometimes difficult problems take a little longer to solve.

We apologize for any inconvenience that the need for repair may cause you. We hope that our rapid service meets your needs. If you have any suggestions to help us improve our service, please give us a call. We appreciate your ideas and will respond to them.

#### **For Your Convenience:**

Please fill in the following and keep this manual with your **Amphenol** system for future reference:

P.O. #: \_\_\_\_\_ Date Purchased: \_\_\_\_\_

Purchased From: \_\_\_\_\_

### Product Support

To obtain support for Amphenol products:

**Visit our website.** <http://www.rjswitch.com>

**Phone:** +33(0) 450 89 28 00

**Fax:** +33(0) 450 96 29 75

**E-mail:** <mailto:contact@rjswitch.com>

**Mailing Address:** Amphenol, Promenade de l'Arve, B.P.29, 74311 Thyez Cedex, France

### For more information

You will find all useful information on the RJ-Switch series on the dedicated website:

<http://www.rjswitch.com>