

October 2016

## APM Unocol 161

Description	
System:	Dual-Cure Adhesive
Resin Type:	Modified Urethane-Acrylate
Colour:	Red
Consistency:	Low viscosity
Solids Content:	100% / Solvent-free
Curing:	UV-Light / Blue Light / Heat
Temp.- Range:	- 55 °C to +125 °C

Application / Specifications	
APM-Number:	103161
Application:	Capillary flow adhesive for electronics
Substrates:	Glass / Metal / Plastics
Biocompatibility:	Compatible
	not certified
Directive 2011/65/EG:	RoHS Compliant
EG - Nr. 1907/2006:	Conforms to REACH

Unocol 161 is a flexible Acrylate-based adhesive that can be cured by either heat, UV or visible light. Unocol 161 is typically used in the electronics industry as an adhesive for displays and other plastic parts. It can be used to mount electronic components, secure wiring and bond plastic parts to glass or metal. It possesses outstanding adhesion to metal and glass surfaces. Its good flow characteristics allow it to be used as a capillary flow adhesive followed by thermal curing. A major advantage of Unocol 161 is that it remains liquid at room temperature for extended periods of time; when required it can then be rapidly cured by exposure to UV or blue light.

Properties of Unhardened Adhesive	
Colour:	Red
Resin Type:	Urethane-Acrylate
Viscosity (25°C):	200 - 400mPa.s
Density (25°C):	1.1 g/cm <sup>3</sup>
Refractive Index (25°C):	1.50

### Surface Preparation / Cleaning

The surfaces to be bonded must be dry and free of any contaminants such as dust, oil and release agents. The surface preparation method used is dependant on the required bond properties such as bond strength and durability. The use of grit blasting, grinding or sanding of metal surfaces usually results in an increase of adhesion strength. In some cases, non-metallic surfaces can also benefit from this type of surface treatment.

Glass surfaces are best cleaned in an aqueous ultrasonic bath at elevated temperatures. Metallic surfaces should be decontaminated with aqueous cleaners or clean solvents.

The plasma treatment of plastic and other surfaces has been proven very effective. Plasma treatment tends to dry surfaces and allows the adhesive to better wet out the surface which optimises bonding. Polymer surfaces that are normally difficult to bond can be chemically treated which will then allow them to be successfully bonded. Surface primers should not be used as a substitute for correct surface preparation. The use of primers after thorough cleaning can increase the adhesive strength and durability of the bond.

Exposure of the adhesive to UV light of a wavelength of 365 nm or blue light of a wavelength of 405 nm results in full cure in a few seconds. Areas of adhesive that cannot be reached by light can be cured thermally by exposure to temperatures above 80 °C.

### Curing of the Adhesive

UV-Light 365 nm	50 mW/cm <sup>2</sup>	15 Seconds
UV-Light 365 nm	1000 mW/cm <sup>2</sup>	3 Seconds
Blue Light 405 nm	50 mW/cm <sup>2</sup>	30 Seconds
Blue Light 405 nm	1000 mW/cm <sup>2</sup>	10 Seconds
Oven at 80 °C		120 Minutes
Oven at 120 °C		30 Minutes

Bonded parts can be further manipulated as soon as the adhesive has cured. Full strength and durability is however only attained after a few days.

### Application of the Adhesive

An ideal working temperature is between 20 and 28°C, higher temperatures result in a lowering of viscosity. Cartridges of adhesive that have been opened do not need to be stored in the refrigerator. Application is usually performed via a dosing unit. However, the adhesive can also be applied using a hypodermic needle or a spatula. Once applied, the adhesive should be cured as soon as possible as the surface of unhardened adhesive tends to remain tacky. The thickness of the adhesive layer can be controlled by the joint dimensions, or by the use of spacers such as glass spheres or fibres.

### Properties of Hardened Adhesive

Colour:	Red
Shore D (25 °C):	60
Thermal Conductivity:	Not Known
Refractive Index (25 °C):	1.50
Thermal Expansion (0–40 °C)	$\alpha = 120 \times 10^{-6} /K$
(-40-0°C)	$60 \times 10^{-6} /K$
(40-85°C)	$170 \times 10^{-6} /K$
Glass Transition Temp. T <sub>g</sub> :	35 .. 45 °C
Tensile Strength (25°C):	20 N/mm <sup>2</sup>
Elongation at Break (25°C):	250 %
Elastic Modulus (25 °C):	200 N/mm <sup>2</sup>
Dielectric Strength:	26.0 kV/mm
Electric Permittivity (25°C):	5.0 at 1.0 KHz

### Removal/Cleaning of the Adhesive

Residues of unhardened adhesive can be removed from substrates, tools and processing equipment by washing with a solvent such as isopropanol or acetone. Beware that the exposure of components made from organic polymers to solvents such as isopropanol or acetone can lead to the partial dissolution of the component, or the formation of stress cracks. In addition, organic solvents can be flammable and must be handled with care and in accordance to their respective Safety Data sheets. The use of solvents should therefore be avoided if possible. Hardened adhesive can only be mechanically removed. The adhesive will become soft at temperatures above 100 °C.

### Service Temperature

The working temperature range for this adhesive is typically between -55 °C and +125°C. In some special cases, uses at temperatures below -55 °C are possible. Please beware that at these very low temperatures the adhesive will become very hard. This hardness may lead to cracking in the plastic substrate or delamination of the adhesive from the substrate. The adhesive becomes relatively soft at temperatures above +100° C . Softening of the adhesive can be advantageous as it is able to compensate for the thermally induced movement of the components without loss of adhesion. The adhesive regains its original physical properties when it cools back down to room temperature.

The adhesive will start to thermally degrade at temperatures above 175 °C

### Tensile Shear Strength

Unocol161 shows good adhesion on various substrates. When tested for tensile shear according to ASTM-D 1002, the following results were obtained:

#### Tensile Shear Strength at 23 °C

Polycarbonate to Glass	7.2 N/mm <sup>2</sup>
Polycarbonate to Polycarbonate	5.2 N/mm <sup>2</sup>
PMMA (Plexiglass) to Glass	5.9 N/mm <sup>2</sup>
PMMA (Plexiglass) to PMMA	4.9 N/mm <sup>2</sup>
ABS to Glass	5.5 N/mm <sup>2</sup>
Soft PVC to Polycarbonate	2.4 N/mm <sup>2</sup>
GFK (Epoxy) to Glass	11.0 N/mm <sup>2</sup>
Glass to Glass	12.5 N/mm <sup>2</sup>

### Aging Characteristics

When used at temperatures of between -55 °C to +125°C, Unocol161 forms very durable bonds that resist aging. At these temperatures the hardened adhesive is also solvent resistant.

#### Tensile Shear Strength on Aging

Polycarbonate to Polycarbonate	5.2 N/mm <sup>2</sup>
7 days in an oven at +125 °C	6.5 N/mm <sup>2</sup>
2h of water storage at 50°C	5.2 N/mm <sup>2</sup>
14 days in an oven at +150 °C	11.3 N/mm <sup>2</sup>
21 days in an oven at +120°C	15.0N/mm <sup>2</sup>
2h in boiling water at 100 °C	5.2 N/mm <sup>2</sup>
7 days at 50 °C and 90% RH	5.2 N/mm <sup>2</sup>
24h in Isopropanol at 23 °C	5.2 N/mm <sup>2</sup>

### Safety Precautions

Avoid skin and eye contact by always using gloves and safety glasses when using this product. If this material contacts the skin (hands), thoroughly wash the contaminated area with warm soapy water. Do not use solvents to clean skin. Eye contact will result in irritation and can lead to permanent eye damage. Please ensure that you have read and understood the relevant MSDS of this product before use.

### Storage

Unopened containers have a shelf life of at least 6 months if they are stored at temperatures between 2 °C und 8 °C. Storage at higher temperatures will shorten the product's shelf life. Storage at lower temperatures will result in a temporary increase in viscosity.

### Compliance

All components in Unocol 161 comply with the RoHS and REACH guidelines. Please ensure that you have read the MSDS before using this product.

### Pack Sizes

Unocol 161 is supplied in black light-proof cartridges. Standard cartridge sizes are 5, 10, 30 and 55 cc. Other special pack sizes can be supplied on request.

### Disposal

Unhardened liquid adhesive is classified as a hazardous waste and must be disposed of in the correct manner that complies to local, state or federal laws. Hardened adhesive is classed as an inert thermoplastic and can be disposed of in commercial and household waste streams.

The specifications in this data sheet are based on meticulous tests and our previous experience in everyday practice. They are non-binding instructions, in the same way as our application advisories are also non-binding, whether verbal, in writing or by trials since we cannot accept any liability due to the wide variety of possible influences during processing and application. APM Technica AG disclaims all other explicit or implicit warranties, conditions and terms, be they of real or legal nature, including those which refer to usual market quality, their suitability for a particular use, satisfactory quality or observance of third-party trademarks. APM Technica excludes all liability to the extent permitted by law – whether arising from contract, quasi contract or tort (including negligence) – for direct, indirect and consequential damages, punitive damages awarded by court, loss of business of all kinds, loss of information or data or any other financial losses which may result from the sale, installation, maintenance, use, performance, failure or interruption of operation of the product or in connection therewith, even if we were informed of the possibility of occurrence of such damages. Data and other specifications concerning the nature and suitability of our products are non-binding general conditions and specifically represents no guarantee of certain characteristics. We advise you to perform your own adequate tests to determine the suitability of our products for your specific application. The user is himself responsible for defining the suitability of production methods mentioned in the technical data sheet for his purposes and for taking precautionary measures which are suitable to protect assets and persons from any danger which may occur during the handling and usage of these products. In all other cases our General Terms and Conditions of Business shall apply.