

File E220480  
Project 01ME18216

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REPORT

on

COMPONENT - CONNECTORS FOR USE IN DATA, SIGNAL,  
CONTROL AND POWER APPLICATIONS

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## DESCRIPTION

## PRODUCT COVERED:

USR Component - Connector series 160, 163, AC 166, AC 166-A, AC 166 E, AC 166 G, AC 166 GE or AC 166-1, may be followed by BU, ST or KU, may be followed by F, blank, KV, BV, LH, LV, PF or VT, followed by /2, /2D, /3, /3D, /3DS, /4, /4D, /5, /5D or /5DS, followed by 2 to 5 letters denoting color.

USR Component - Connector series AC 166 VLCG and AC 166 ALCGB, refer to nomenclature for details.

**USR Component - Connector series AC 164, refer to nomenclature for details.**

## GENERAL:

USR - indicates investigation to United States Standards, UL 1977, First Edition.

These devices are multipole connectors intended for factory assembly. These Connectors consist of male or female connectors with pressure wire connections or Push-In Type (Wire Secured by Spring Type Action). The houses are provided with suffixes for constructional details.

## ELECTRICAL RATINGS:

Type	No. of poles	Type Designation	Electrical Rating	Wire Range	Torque
160 BU/3 with or without DS 160 BU/5 with or without DS 163 ST/3 with or without DS 163 ST/5 with or without DS AC 166 EBU/3 AC 166 EST/3 AC 166 KU/3 AC 166 GBU/3** AC 166 GST/3** AC 166 GKU/3	3 ** 3 through 5	2	16 A, 600 V	14 SOL/STR	0.6 Nm
AC 166 GEBU/3 AC 166 GEST/3 AC 166 GEKBU/3 AC 166 GEKBUV/3 AC 166 GEKST/3 AC 166 GEKSTV/3	3 through 5	2	16A, 600V	14-18 sol/str	0.6 Nm
AC 166-1 BU/3 AC 166-1 ST/3	3	2	16A, 600V	14 sol/str	0.6 Nm
AC 166 may be followed by -A BU/ followed by 2,3,4 or 5 AC 166 may be followed by -A ST/ followed by 2,3,4 or 5 AC 166 may be followed by -A BUD/ followed by 2,3,4 or 5 AC 166 may be followed by -A STD/ followed by 2,3,4 or 5	2 thru 5	2	16 A, 600 V	14 SOL/STR	0.6 Nm
**AC 166 BUF/3 AC 166 STF/3	3	2	16 A, 600 V	14 SOL/STR	0.4 Nm
AC 166 GBUF/3 AC 166 GSTF/3	3 through 5	2	16A, 600V	14-18 sol/str	0.4 Nm
AC 166 VLCG, AC 166 ALCGB, AC 166 ALCGS	3 through 5	2	16A, 600V	14-18 sol/str	0.4 Nm
AC 166 GEBUBV/3 AC 166 GESTBV/3 AC 166 GEBUKV/3 AC 166 GESTKV/3	3	2	16 A, 600 V	14 SOL/STR	0.4 Nm
AC 166 GBULH/3 AC 166 GSTLH/3 AC 166 GBULV/3 AC 166 GSTLV/3	3 through 4	2	16 A, 600 V	--	--
AC 166 GBUPF/3 AC 166 GSTPF/3	3	2	16 A, 600 V	14 sol	--
*AC 166 GVT/3	3 + 4	2	16A/600V	--	--
<b>AC 164</b>	<b>2 through 5</b>	<b>2</b>	<b>16A/600V</b>	<b>16 sol</b>	<b>0.5 Nm</b>

NOMENCLATURE CODE: AC 166 GBUF/3

Example:            AC 166 G    BU    F    /3    black  
                           A            B        C        D        E

## A. Basic Type -

160  
 163  
 AC 166  
 AC 166-A  
 AC 166 E  
 AC 166 G  
 AC 166 GE  
 AC 166-1

## B. Construction -

BU - Female Connector  
 ST - Male Connector  
**KU - Coupler**

## C. Types Designation

F - Flat version  
 None - Not flat version  
**KV - built-in plugs and sockets to be used in plastic frames**  
**BV - built-in plugs and sockets to be used in metal frames**  
**LH - plugs and sockets with horizontal solder pins**  
**LV - plugs and sockets with vertical solder pins**  
**PF - flat plugs and sockets with strain relief, screwless**  
**VT - distributing blocks (1 input, 2 output terminals)**

## D. Number of poles -

/2 - 2 poles  
 /2D - 2 poles with 2 wire terminals per pole  
 /3 - 3 poles  
 /3D - 3 poles with 2 wire terminals per pole  
 /3DS - 3 poles with wire protector  
 /4 - 4 poles  
 /4D - 4 poles with 2 wire terminals per pole  
 /5 - 5 poles  
 /5D - 5 poles with 2 wire terminals per pole  
 /5DS - 5 poles with wire protector

## E. Color

AC 166	VLCG	/315	060	H05VV5-F	schwarz-	grau
1	2	3	4	5	6	7

1 = AC 166 G = Basic type

2 = VLC = connector

3 = /first digit indicates the number of poles  
two digit number indicates wire size in mm<sup>2</sup> (15 = 1.5 mm<sup>2</sup>)

4 = Length of cabel in cm

5 = Cabel Type

6 = Color of the connector

7 = Color of Cable

AC 166	ALCG	B	/315	300	H05VV5-F	schwarz	-grau
1	2	3	4	5	6	7	8

1 = AC 166 G = Basic type

2 = ALC = extension

3 = B - female  
S - male

4 = /first digit indicates the number of poles  
two digit number indicates wire size in mm<sup>2</sup> (15 = 1.5 mm<sup>2</sup>)

5 = Length of cabel in cm

6 = Cabel Type

7 = Color of the connector

8 = Color of Cable

NOMENCLATURE CODE: AC 164

Example:            AC 164    ALSB    /515    white    GW  
                          A            B            C            D            E

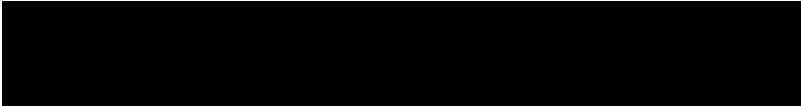
A.    Basic series -  
      AC 164

B.    Construction -  
      BU    ST    - Plug / Connector, rewirable, screw type terminal, for  
                  built- in, with retaining means.  
      BUF    STF    - Plug / Connector, rewirable, screw type terminal, with  
                  strain relief, with retaining means  
      ALSB ALSS - Extension cable, connector / plug, rewirable, screw type  
                  terminal, with strain relief, with retaining means  
      VLS            - Extension cable, connector / plug, rewirable, screw type  
                  terminal, with strain relief, with retaining means

C.    Number of poles  
      /2 - 2 pole  
      /3 - 3 pole  
      /4 - 4 pole  
      /5 - 5 pole

D.    color-  
      White  
      Black  
      Pastel blue

E.    Types of material



## ENGINEERING CONSIDERATIONS (NOT FOR UL REPRESENTATIVE USE):

Use - For use only in complete equipment where the acceptability of the combination is determined by Underwriters Laboratories Inc.

Conditions of Acceptability - In order to be judged acceptable as a component of electrical equipment, the following conditions should be met.

1. These devices have not been tested for interrupting the flow of current by connecting or disconnecting the mating connector. If the devices will be routinely connected or disconnected under load in the end-use application, tests to evaluate the devices' ability to withstand the resulting electrical arc should be considered. The number of make-and-break cycles, the supply voltage and power factor, and the current carried by each pole of the device in the test are to be developed based upon the conditions that will be present in the end-use. The Overload, Temperature and Resistance to Arcing test sequence in UL 1977, the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, is an example of a test program that can be used in such an evaluation.

\* 2. Series 160 BU followed by /3 or /5 with or without DS and 163 ST followed by /3 or /5 with or without DS and AC 166 followed by BUF/, STF/, EBU/, EST/, GBU/, GST/, GBUF/, GSTF/, GEBU/ or GEST/ followed by 3 and AC 166 followed by BU/, ST/, BUD/ or STD/ followed by 2,3,4 or 5 and AC 166-1 followed by BU/3, ST/3, have not been evaluated for its suitability as a protective conductor.

\* 3. The mounting means was not evaluated .

4. The electrical and mechanical suitability of the wiring terminals shall be determined in the end use.

5. The placement of these devices within the equipment enclosure should be such that spacings between the live parts and the equipment are suitable for the particular application.

6. These devices have been investigated for a current of 16 A carried by each pole.

7. The operating temperature of these devices should not exceed the temperature ratings of the insulating materials as indicated under item 13 of the Conditions of Acceptability or Construction Details. These materials may be used interchangeably.

8. These devices employ terminals, which are not suitable for field wiring.

9. The strain relief's are to be investigated for the application.

\* 10. Mold Stress Relief testing were conducted at a temperature of 135°C for [REDACTED]

11. These devices have been subjected to the Temperature test described in UL 1977, the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, with the rated currents and maximum temperature rise values tabulated below. The conductors terminated by the device and other associated components are to be reviewed in the end-use to determine whether the temperature rise from the connector exceeds their maximum operating temperature ratings.

Types	Insulation Material	Wire Size	Current , A	Torque , Nm	Maximum Temperature Rise, °C.
163 ST/3 w. 160 BU/3		14 AWG SOL, Cu	16	0.6	31.4
AC 166 BU/5 w. AC 166 ST/5		14 AWG STR, Cu	16	0.6	19.4
AC 166 GBUF/3 w. AC 166 GSTF/3		14 AWG SOL, Cu	16	0.4	24.4
AC 166 EBU/3 w. AC 166-1 ST/3		14 AWG SOL, Cu	16	0.6	26.8
AC 166 EST/3 w. AC 166-1 BU/3		14 AWG STR, Cu	16	0.6	28.7
AC 166 GBUF/5 AC 166 GSTF/5		14 AWG sol/str	16	0.6	42
AC 166 GEBU AC 166 GEST		14 AWG sol/str	16	0.6	40
AC 166 GBULH/4 AC 166 GSTLH/4		--	16	--	45
AC 166 GEBU/5 AC 166 GEST/5		18 AWG sol/str	16	0.6	64
AC 166 GEBUF/5 AC 166 GESTF/5		18 AWG sol/str	16	0.4	65.7
<b>AC 164 BUF</b> <b>AC 164 STF</b>		<b>16 sol</b>	<b>16</b>	<b>0.5</b>	<b>42.1</b>

12. These devices may be used at potentials not exceeding 600 V based on Dielectric Voltage-Withstand testing conducted at 2200 V ac in accordance with UL 1977, the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications.

13. The insulating materials used in these devices comply with the requirements of UL 1977, the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications. See table below for manufacture and type.

Series	Manufacture	Material	Base Material Temperature Rating.
160 163 AC 166 AC 166-1			110 °C
			110°C
			110°C
			110°C



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## CONSTRUCTION DETAILS:

The details of construction are illustrated in the following descriptive pages and accompanying photographs.

Spacings - Minimum of 1.2 mm (3/64 in.) for devices rated 250 V or less, minimum of 3.2 mm. (1/8 in.) for devices rated greater than 250 V provided through air and over surface between live-metal parts of opposite polarity and between live parts and exposed dead-metal parts.

MARKING - The marking of a Component Connectors for Use in Data, Signal, Control and Power Applications shall include:

1. Recognized Company's name, trade name or trademark shall appear on the device.
2. The catalog number or series designation shall appear on the device, shipping carton, or stuffer sheet, placed in the shipping carton.
3. The Factory Identification which may be marked on the device, shipping carton, or stuffer sheet, placed in the shipping carton.
4. The electrical rating in both volts and amperes (if assigned), whether ac or dc (if restricted) and Flammability class (if identified), shall appear on the device, shipping carton, or stuffer sheet, placed in the shipping carton.
5. "Not for current interrupting", "For disconnect use only", or with an equivalent statement, shall appear on the device, shipping carton, or stuffer sheet, placed in the shipping carton.

Insulating materials - R/C Plastic (QMFZ2), used in these devices comply with the requirements of UL 1977, the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications. The following QMFZ2 is employed in these devices.

Series	Manufacture	Material	Base Material Temperature Rating.
160			110 °C
163			110°C
AC 166			110°C
AC 166-1			110°C
<b>AC 164</b>			<b>110°C</b>
<b>AC 164</b>			<b>110°C</b>
<b>AC 164</b>			<b>110°C</b>

Model differences - Models with suffix "A" are identical to type AC 166 followed by BU/ or BUD/ followed by 2,3,4 or 5 and type AC 166 followed by ST/ or STD/ followed by 2,3,4 or 5.

- A. 160 BU/3 (REPRESENT AC 160 BU/3DS, 160 BU/5 with or without DS)  
 B. 163 ST/3 (REPRESENT AC 163 ST/3DS, 163 ST/5 with or without DS)  
 - FIG.1 (D0100783) **and Ills. 6**

General - The general design, shape and arrangement shall be as illustrated except where variations are specifically described. See Ill. 1 for assembly and dimensional details.

1. Insulating Body - R/C Plastic (QMFZ2). Refer to Construction Details for manufacture and type. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness	Illustration
160 BU/3	16.5	23.7	26.8	1.0	1
163 ST/3	16.5	24.1	29.5	0.7	1

2. Male/female contact - Plated Copper steel, provided with one hole for M3 screw and one hole for wire entry. For male/female ground contacts the overall length may vary. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness
160 BU/3	5.8	4.5	13.7	0.7
163 ST/3	5.8	4.5	18.5	0.7

3. Screw - Plated steel, Slot-headed. Overall dimensions are tabulated below in mm.

Type	Screw Size	Overall Diameter	Overall Length	Overall Thread Length
160 BU/3	M3	3.6	6.9	5.5
163 ST/3	M3	3.5	7.5	5.9

- C. AC 166 BU/5 (REPRESENT AC 166 FOLLOWED BY BU/ OR BUD/ FOLLOWED BY 2,3 or 4 AND AC 166 GBU/3)
- D. AC 166 ST/5 (REPRESENT AC 166 FOLLOWED BY ST/ OR STD FOLLOWED BY 2,3 or 4 AND AC 166 GST/3) - FIG.2 (D0100784) **and Ills. 6**

General - The general design, shape and arrangement shall be as illustrated except where variations are specifically described. See Ill. 2 for assembly and dimensional details. The above-mentioned types represents models with suffix "A".

1. Insulating Body - R/C Plastic (QMFZ2). Refer to Construction Details for manufacture and type. The length varies with number of poles. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness	Illustration
AC 166 BU/5	33.6	19.5	48.0	0.67	2
AC 166 ST/5	34.0	19.5	48.0	0.57	2

2. Male/female contact - Plated Copper steel, provided with one hole for M3 screw and one hole for wire entry. For male/female ground contacts the overall length may vary. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness
AC 166 BU/5	6.1	4.7	17.5	0.7
AC 166 ST/5	5.9	4.7	17.9	0.9

3. Screw - Plated steel, Slot-headed. Overall dimensions are tabulated below in mm.

Type	Screw Size	Overall Diameter	Overall Length	Overall Thread Length
AC 166 BU/5	M3	4.0	8.0	6.0
AC 166 ST/5	M3	4.0	8.0	6.0

- E. AC 166 EBU/3 (REPRESENT AC 166 GEBU/3)  
 F. AC 163 EST/3 (REPRESENT AC 166 GEST/3) - FIG.3 (D0100785) **and Ills. 6**

General - The general design, shape and arrangement shall be as illustrated except where variations are specifically described. See Ill. 3 for assembly and dimensional details.

1. Insulating Body - R/C Plastic (QMFZ2). Refer to Construction Details for manufacture and type. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness	Illustration
AC 166 EBU/3	16.7	37.5	38.5	0.3	3
AC 166 EST/3	16.7	37.5	38.5	0.3	3

2. Male/female contact - Plated Copper steel, two parted construction, provided with spring for wire entry. For male/female ground contacts the overall length may vary. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness
AC 166 EBU/3	8.8	5.8	23.9	0.3
AC 166 EST/3	8.8	5.8	24.3	0.3

- G. AC 166 GBUF/3 (REPRESENT AC 166 BUF/3)  
 H. AC 166 GSTF/3 (REPRESENT AC 166 STF/3) - FIG.4 (D0100786) **and Ills. 6**

General - The general design, shape and arrangement shall be as illustrated except where variations are specifically described. See Ill. 4 for assembly and dimensional details.

1. Insulating Body - R/C Plastic (QMFZ2). Refer to Construction Details for manufacture and type. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness	Illustration
AC 166 GBUF/3	12.6	28.0	68.2	0.9	4
AC 166 GSTF/3	12.6	28.0	68.2	0.7	4

2. Male/female contact - Plated Copper steel, provided with one hole for M3 screw and one hole for wire entry. For male/female ground contacts the overall length may vary. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness
AC 166 GBUF/3	5.1	4.5	21.8	0.7
AC 166 GSTF/3	5.1	4.5	22.0	0.7

3. Centre screw - Plated steel, Slot-headed. Overall dimensions are tabulated below in mm.

Type	Screw Size	Overall Diameter	Overall Length
AC 166 GBUF/3	M3	2.9	4.1
AC 166 GSTF/3	M3	2.9	4.1

- I. AC 166-1 BU/3 (REPRESENT AC 166)  
 J. AC 163-1 ST/3 (REPRESENT AC 166) - FIG.5 (D0100787) **and Ills. 6**

General - The general design, shape and arrangement shall be as illustrated except where variations are specifically described. See Ill.5 for assembly and dimensional details.

1. Insulating Body - R/C Plastic (QMFZ2). Refer to Construction Details for manufacture and type. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness	Illustration
AC 166-1 BU/3	19.5	31.6	28.0	0.7	5
AC 166-1 ST/3	19.5	31.6	28.0	0.7	5

2. Male/female contact - Plated Copper steel, provided with one hole for M3 screw and one hole for wire entry. For male/female ground contacts the overall length may vary. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness
AC 166-1 BU/3	6.0	4.7	21.5	0.8
AC 166-1 ST/3	6.0	4.7	22.0	0.8

3. Screw - Plated steel, Slot-headed. Overall dimensions are tabulated below in mm.

Type	Screw Size	Overall Diameter	Overall Length	Overall Thread Length
AC 166-1 BU/3	M3	4.0	8.0	6.0
AC 166-1 ST/3	M3	4.0	8.0	6.0

AC 166 GKU (coupler)

Fig. 6

General - The general design, shape and arrangement shall be as illustrated except where variations are specifically described.

1. Insulating Body - R/C Plastic (QMFZ2). Refer to Construction Details for manufacture and type. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness	Illustration
AC 166 GKU	12.5	28.0	39.0	0.7	7

2. Contact - Plated Copper alloy. For shape and dimensions see Ills. 8.



AC 166 GVT (distributor)

Fig. 7

General - The general design, shape and arrangement shall be as illustrated except where variations are specifically described. See Ill.9 for assembly and dimensional details.

1. Insulating Body - R/C Plastic (QMFZ2). Refer to Construction Details for manufacture and type. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness	Illustration
AC 166 GVT	42.9	28.2	58.0	0.7	9

2. Male/female contact - Plated Copper alloy. For shape and dimensions see Ills. 10 & 10A.

AC 166 GBUL (H- horizontal, V- vertical)  
(connector with soldering pins, 90° and 180° angled)

Fig. 8

General - The general design, shape and arrangement shall be as illustrated except where variations are specifically described. See Ill.11 for assembly and dimensional details.

1. Insulating Body - R/C Plastic (QMFZ2). Refer to Construction Details for manufacture and type. Overall dimensions are tabulated below in mm.

Type	Overall Height	Overall Width	Overall Length	Minimum Thickness	Illustration
AC 166 GBUL	13	24	*	1.7	11

\* varies with the number of poles (3 through 4 poles)

2. Male/female contact - Niquel plated copper alloy, provided with solder pin integrated. For vertical and horizontal connection. See Ills. 12 & 13 for shape and dimensions.

AC 166 VLCG, AC 166 ALCGB, AC 166 ALCGS

General - AC 166 VLCG, AC 166 ALCGB, AC 166 ALCGS connectors are AC 166 G connectors where cable type H05VV5-F is attached.

AC 164

Fig. 9

General - The general design, shape and arrangement shall be as illustrated except where variations are specifically described.

1. Insulating Body - R/C Plastic (QMFZ2). Refer to Construction Details for manufacture and type. Overall dimensions are tabulated below in mm.

poles	Overall Height	Overall Width	Overall Length	Minimum Thickness	Illustration
2	11.35	18.4	51.1	0.9 mm	14
3	11.35	21	53.6		15
4	13.45	26.4	56.3		16
5	13.45	31.7	56.3		17

2. Male/female contact - tin plated Copper alloy. For shape and dimensions see Ills 18 and 19.
3. Clamping screw - M3 plated steel head screw. For shape and dimensions see Ills 20.