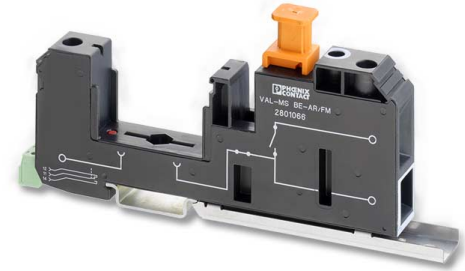


# VAL-MS-AR...

## Surge protection and connection for railroad controls and signals



Data sheet  
3100\_en\_B

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### 1 Description

The VAL-MS-AR ...(/FM) surge protective device (SPD) modules provide reliable, touch-safe surge protection and termination specifically for railroad control and signal systems. The base has independent field input and house output terminals on the same side with ground terminals on the opposite end. A quick disconnect pin and test point separates the field input and house output for simple field diagnosis and insulation resistance tests.

Compliant with AREMA C & S recommended practices, the VAL-MS-AR ...(/FM) replaces the stud and nut terminal-style connections used in the past with a modern alternative that is easy to install, test and repair in the event of a damaged surge protection plug.

In addition to the standard VAL-MS-AR..., the VAL-MS-AR.../FM provides a remote monitoring function that signals a remote device through a set of dry contacts, providing immediate notification when a surge protection plug is damaged or missing.

A common base element (VAL-MS BE-AR(/FM)) accommodates different plugs for different modes and levels of protection. The VAL-MS-AR ...VF(/FM) modules are a hybrid SPD with a gas discharge tube in series with a metal oxide varistor and a thermal monitor. These modules are ideal for low-current signal applications where no leakage current can be tolerated.

VAL-MS-AR T1/T2 ...(/FM) modules are high-capacity SPD for Type 1 lightning, as well as for Type 2 switching surge currents. It is ideal for higher current applications and locations with a high lightning surge risk.

#### 1.1 Features

- Pluggable surge protection for quick repairs
- Protects systems from direct lightning strikes and coupled surge energy
- Local status indication on plugs for easy location of expired plugs
- Optional remote status indication through dry contacts
- Simple, tool-free disconnect pin and test point for isolating field wires during maintenance and insulation resistance test
- Screw-type wire clamps for copper wire up to 4 AWG, solid and stranded, stripped or ferruled
- Convenient labeling solutions



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This data sheet is valid for all products listed on the following page:

## 2 Ordering data

### Products

Description	Type	Order No.	Pcs. / Pkt.
<b>Module</b> , for up to 60 V AC/DC, hybrid Type 2 surge protection with zero leakage current	VAL-MS-AR 75 VF	2801487	10
<b>Module</b> , for up to 60 V AC/DC, hybrid Type 2 surge protection with zero leakage current, function monitor contacts	VAL-MS-AR 75 VF/FM	2801488	10
<b>Module</b> , for up to 240 V AC, hybrid Type 2 surge protection with zero leakage current	VAL-MS-AR 350 VF	2801489	10
<b>Module</b> , for up to 240 V AC, hybrid Type 2 surge protection with zero leakage current, function monitor contacts	VAL-MS-AR 350 VF/FM	2801490	10
<b>Module</b> , for up to 60 V AC/DC, Type 1/2 lightning surge protection	VAL-MS-AR T1/T2 75	2801491	10
<b>Module</b> , for up to 60 V AC/DC, Type 1/2 lightning surge protection, function monitor contacts	VAL-MS-AR T1/T2 75/FM	2801492	10
<b>Base element</b> for surge protection, with disconnect; DIN rail mount with retention screw; no surge protection plug	VAL-MS BE-AR	2801065	10
<b>Base element</b> for surge protection, with disconnect; DIN rail mount with retention screw; function monitoring contacts; no surge protection plug	VAL-MS BE-AR/FM	2801066	10

### Accessories

Description	Type	Order No.	Pcs. / Pkt.
<b>Bridge</b> , for connecting modules with 17.5 mm pitch, 57 pos.	MPB 18/1-57	2809238	1
<b>Bridge</b> , for connecting modules with 17.5 mm pitch, 2 pos.	MPB 18/1-2	2809209	10
<b>Bridge</b> , for connecting modules with 17.5 mm pitch, 12 pos.	MPB 18/1-12	2748593	10
<b>Bridge</b> , for parallel circuits, 2 pos.	FBS 2-18	2801068	10
<b>Zack marker strip</b> , white, unlabeled	ZBN 18:UNBEDRUCKT	2809128	10
<b>Card</b> , sheet, white, 32 labels	UC-TMF 16	0819262	10
<b>Screwdriver</b> , slot-headed, VDE insulated, for L0 house termination clamp screw	SZS 0,8X4,0 VDE	1212508	1
<b>Screwdriver</b> , slot-headed, VDE insulated, for L1 field termination clamp screw	SZS 1,0X6,5 VDE	1205079	1
<b>Screwdriver</b> , slot-headed, VDE insulated, for FM termination clamp screw	SZS 0,4X2,5 VDE	1205037	1

### Replacement parts

Description	Type	Order No.	Pcs. / Pkt.
<b>Plug</b> , for 60 V AC/DC with hybrid Type 2 surge protection, zero leakage current	VAL-MS 75 VF ST	2805318	10
<b>Plug</b> , for 240 V AC with hybrid Type 2 surge protection, zero leakage current	VAL-MS 350 VF ST	2856595	10
<b>Plug</b> , for 60 V AC/DC with hybrid Type 1/2 surge protection, lightning surge protection	VAL-MS-T1/T2 75/12.5 ST	2801146	10
<b>Connector</b> , for function monitoring	MC 1,5/3-ST-5,08	1836082	50

### 3 Technical data

#### General data

##### Dimensions

VAL-MS-AR...	153 x 17.6 x 74 mm (6.02 x 0.69 x 2.91 in.)
VAL-MS-AR.../FM	160 x 17.6 x 74 mm (6.30 x 0.69 x 2.91 in.)

##### Weight

VAL-MS-AR 75 VF	150 g (0.33 lb.)
VAL-MS-AR 75 VF/FM	154 g (0.34 lb.)
VAL-MS-AR 350 VF	156 g (0.34 lb.)
VAL-MS-AR 350 VF/FM	160 g (0.35 lb.)
VAL-MS-AR T1/T2 75	195 g (0.43 lb.)
VAL-MS-AR T1/T2 75/FM	199 g (0.44 lb.)
VAL-MS BE-AR	120 g (0.26 lb.)
VAL-MS BE-AR/FM	124 g (0.27 lb.)

##### Ambient temperature, operating

-40 ... +80°C (-40 ... +176°F)

##### Relative humidity

0 ... 95%: AREMA 14.1.2.G.3

##### Altitude

3000 m (9842 ft) above sea level

##### Mounting type

DIN rail mounting (NS 35) with additional retaining screw

##### Color

Black

##### Inflammability according to UL94

V0

##### Pollution degree

2

##### Degree of protection

IP20

##### Housing material

PA (polyamide)

#### Connection data

##### Connection type

Screw

##### Ground wire connection, $\perp$

Size	15 ... 2 AWG, 1.5 ... 35 mm <sup>2</sup>
Torque	3.0 ... 4.5 Nm (26.5 ... 39.8 lb <sub>f</sub> -in.)
Strip length	16 mm (0.63 in.)

##### House wire connection, L0

Size	20 ... 6 AWG, 0.5 ... 15 mm <sup>2</sup>
Torque	1.5 ... 1.8 Nm (13.3 ... 15.9 lb <sub>f</sub> -in.)
Strip length	10 mm (0.39 in.)

##### Field wire connection, L1

Size	12 ... 4 AWG, 1.5 ... 25 mm <sup>2</sup>
Torque	2.5 ... 3.0 Nm (22.1 ... 26.5 lb <sub>f</sub> -in.)
Strip length	14 mm (0.55 in.)

##### Function monitor connection

Size, UL rating	30 ... 14 AWG
Size, CSA rating	28 ... 16 AWG
Size, IEC rating	0.08 ... 2.0 mm <sup>2</sup>
Torque	0.25 Nm (2.2 lb <sub>f</sub> -in.)
Strip length	7 mm (0.27 in.)

#### Electrical data

Operating frequency	50 ... 60 Hz
Current rating, protection circuit	80 A AC/DC
Current rating, function monitor, typical	5 mA @ 5 V minimum
Current rating, function monitor, maximum	1.5 mA
Voltage rating, protection circuit	240 V AC/DC
Voltage rating, function monitor	250 V AC/30 V DC

**Surge protection data**

Maximum discharge surge current, 8/20 $\mu$ s, $I_{max}$ (VAL-MS BE-AR/(FM)...) only)	100 kA
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Short circuit current rating, SCCR	25 kA
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Protection level with **VAL-MS 75 VF ST** plug

UL nominal discharge current, $I_n$	10 kA
VPR (3 kA/6 kV, IEEE combo wave)	370 V
Protection level, 20 surges (10+, 10-, 8/20 $\mu$ s), $U_p$	1003 V @ 25 kA
Protection level, 2 surges (1+, 1-, 8/20 $\mu$ s), $U_p$	1815 V @ 48 kA
Lightning protection level, 20 surges (10+, 10-, 10/350 $\mu$ s), $U_{IMP}$	584 V @ 5 kA
Lightning protection level, 2 surges (1+, 1-, 10/350 $\mu$ s), $U_{IMP}$	788 V @ 15 kA

Protection level with **VAL-MS 350 VF ST** plug

UL nominal discharge current, $I_n$	10 kA
VPR (3 kA/6 kV, IEEE combo wave)	840 V
Protection level, 20 surges (10+, 10-, 8/20 $\mu$ s), $U_p$	1495 V @ 15 kA
Protection level, 2 surges (1+, 1-, 8/20 $\mu$ s), $U_p$	2130 V @ 21 kA
Lightning protection level, 20 surges (10+, 10-, 10/350 $\mu$ s), $U_{IMP}$	334 V @ 3.0 kA
Lightning protection level, 2 surges (1+, 1-, 10/350 $\mu$ s), $U_{IMP}$	348 V @ 3.7 kA

Protection level with **VAL-MS-T1/T2 75/12.5 ST** plug

UL nominal discharge current, $I_n$	20 kA (8/20 $\mu$ s)
IEC lightning discharge current, $I_{IMP}$	12.5 kA (10/350 $\mu$ s)
VPR (3 kA/6 kV, IEEE combo wave)	613 V
Protection level, 20 surges (10+, 10-, 8/20 $\mu$ s), $U_p$	1536 V @ 50 kA
Protection level, 2 surges (1+, 1-, 8/20 $\mu$ s), $U_p$	2345 V @ 85 kA
Lightning protection level, 20 surges (10+, 10-, 10/350 $\mu$ s), $U_{IMP}$	960 V @ 17 kA
Lightning protection level, 2 surges (1+, 1-, 10/350 $\mu$ s), $U_{IMP}$	930 V @ 21 kA

**Mechanical tests/Conformance**

## Vibration (AREMA 11.5.1.D.4; 14.1.2.G.6)

5...20 Hz	0.07 in. water p-p
20...200 Hz	1.5g peak

Mechanical shock (AREMA 11.5.1.5)	10g peak
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Dielectric strength	3000 V
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Abrasive environment	Dust: MIL-STD-810F, Method 510.4
	Salt: IEC 60068-2.52, 6.2
	Corrosion: AREMA 14.1.2

## 4 Temperature rise

Current (A)	Temperature rise (°C)
0	0
30	12.21
45	26.70
60	45.83
75	68.23

*Test criteria: Five active bases connected in series*

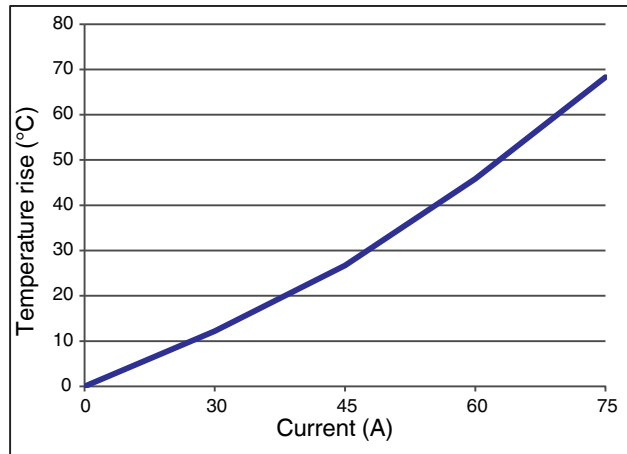


Figure 1 Temperature rise between L0 and L1 across disconnect

Current (A)	Temperature rise (°C)
0	-0.62
10	0.65
20	5.64
30	14.34
40	32.28
50	44.06
60	59.75

*Test criteria: Four active bases connected in series using three FBS bridges*

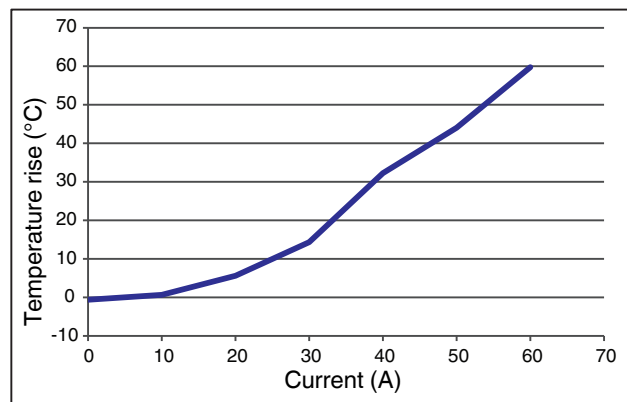


Figure 2 Temperature rise through an FBS bridge (L1 - L1)

## 5 Dimensions

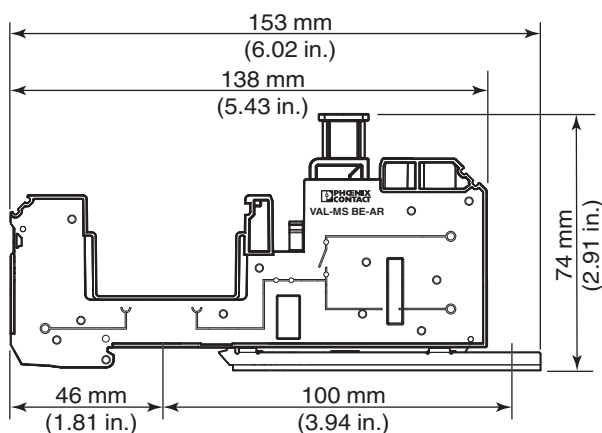


Figure 3 VAL-MS BE-AR dimensions

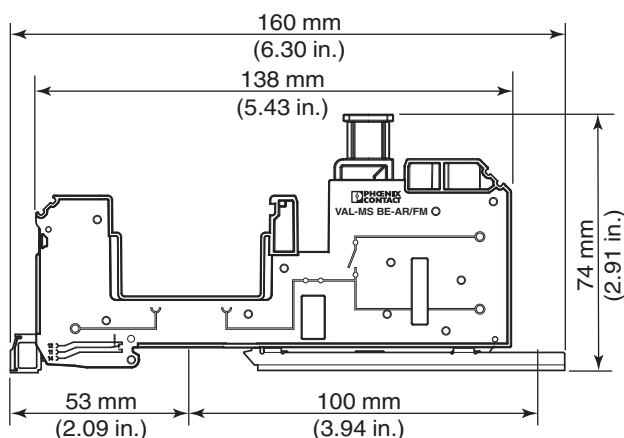


Figure 4 VAL-MS BE-AR/FM dimensions

## 6 Safety notes

Installation and maintenance work on this device may only be carried out by an authorized electrician.

The manufacturer's warranty is invalid if the VAL-MS BE-AR... surge protective device is opened.

## 7 Installation

1. Hook the ground end of the base on the top of the rail. Rotate the opposite end into the rail until it snaps into place.
2. Secure the device to the back panel by inserting the self-tapping screw through the retention foot.
3. Strip 0.4 in. (10 mm) of the house wire insulation and insert it into the lower terminal, L0. Tighten the wire clamp screw to 13 - 16 lb<sub>f</sub>-in. (1.5 - 1.8 Nm).

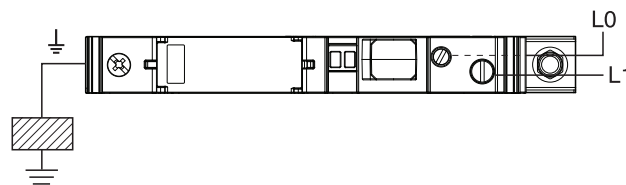


Figure 5 Connections

4. Strip 0.55 in. (14 mm) of the field wire insulation and insert it in the upper terminal, L1. Tighten the wire clamp screw to 22 - 27 lb<sub>f</sub>-in. (2.5 - 3.0 Nm).
5. Strip 0.63 in. (16 mm) of the ground wire insulation and insert it in the ground terminal,  $\perp$ . Alternately, install a grounding bar. Tighten the ground screws to 27 - 40 lb<sub>f</sub>-in. (3.0 - 4.5 Nm).
6. (VAL-MS-AR.../FM only) Connect monitoring circuit to green connector according to Figure 6. Strip 0.28 in. (7 mm) of insulation from each conductor before inserting into the appropriate position. Tighten wire clamp screws to 2 - 4 lb<sub>f</sub>-in. (0.25 Nm).

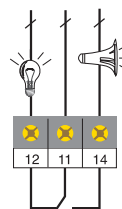


Figure 6 Function monitor installation

7. If not already equipped, install arrestor plug as specified for the circuit being tested.

## 8 Testing/Maintenance

### 8.1 Diagnostic disconnection



**WARNING:**

Always disconnect power to the device before moving the disconnect button. Arc flash may occur.

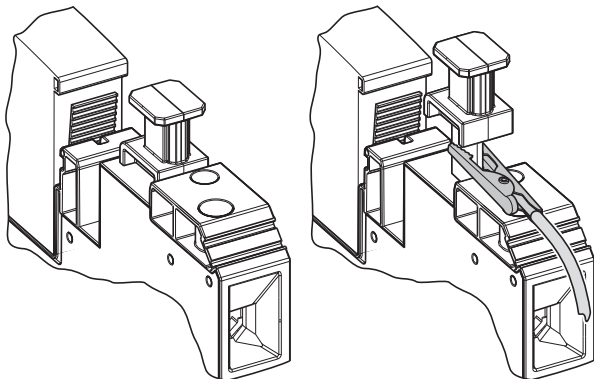


Figure 7 Test equipment field connection

- Lift the orange button to disconnect the circuit. Connect test equipment to field wire by attaching to exposed disconnect metal using an alligator clip.
- When finished, remove alligator clip and push orange button in to connect circuit.

### 8.2 Plug replacement

The plug has a visual status indicator. If the window is green, it is functioning. If it is red, the plug must be removed and replaced.

To replace plug:

1. Squeeze the tabs on each end of the plug and pull it straight out of the base.
2. Obtain a replacement plug of the same rating.



Each plug is keyed in a specific way. If the keyway is not the same as the plug removed, it will not fit into the base.

3. Orient the plug properly with the base, making sure the keyway aligns with the key slot in the base. Push the plug straight into the base until the retaining tabs on each end of the plug snap into the base.

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