



# ***AD-7***

## ***Thermal Indicating Ammeter***



# ***Instruction Manual***



## **HD ELECTRIC COMPANY**

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# AMPERE DEMAND METER

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# AMPERE DEMAND METER

## SECTION 1

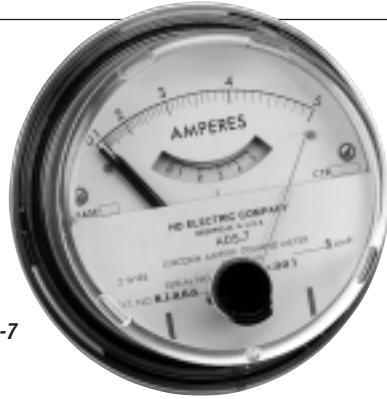
### GENERAL INFORMATION

#### 1.1 INTRODUCTION

HD Electric Company has prepared this instruction manual to provide the information necessary for installation, operation and maintenance of type AD-7 thermal indicating ammeters.

#### 1.2 GENERAL DESCRIPTION

AD-7 ammeters are used to give an indication of current loading on transformers and distribution feeders, underground distribution systems and on major pieces of equipment. They are instruments that register 90% of the change in current over one response interval. The meter is available as either a semi-flush switchboard type ADF-7 or a socket mounting type ADS-7 (Figure 1.1). Both can be furnished with instantaneous indicating ammeters.



ADS-7



ADF-7

Figure 1.1 ADF-7 and ADS-7

#### 1.3 SPECIFICATIONS

- Weight . . . . . ADF-7: 0.7kg (1.5 lbs.)  
ADS-7: 0.9kg (2 lbs.)
- Thermal Response Interval . . . . . 5 minutes
- Temperature Range . . . . . -20°C to +50°C (-4°F to +122°F)

#### • Burden Data

	R (ohms)	X	Z	V.A.	P.F.
All meters (at rated current)	*	*	*	3.75	0.95
Instantaneous ammeter add: (at rated current)	*	*	*	0.35	0.95

To calculate R, X and Z for other meters:

$$R = \frac{(0.95) \text{ V.A.}}{(\text{rated current})^2}$$

$$X = \frac{(0.31) \text{ V.A.}}{(\text{rated current})^2}$$

$$Z = \frac{\text{V.A.}}{(\text{rated current})^2}$$

## SECTION 2

### INSTALLATION

#### 2.1 STORAGE/UNPACKING

Handle carefully to avoid damage to the mechanism or case.

#### 2.2 SITE SELECTION

The ADF-7 semi-flush switchboard meter should be installed in an enclosure that provides protection from the rain. The ADS-7 socket type meter is intended for use in outdoor environments.

#### 2.3 INSTALLATION

##### 2.3.1 ADF-7

- Step 1 Make cutout in panel according to Figure 2.1.
- Step 2 Refer to Figure 2.2. Remove screws (A) from the sides of the meter and separate meter from tray.
- Step 3 Secure meter tray to panel by fastening screws (B) through the tray flange and panel to mounting tabs (C).
- Step 4 Slide meter into the tray and secure by replacing screws either into the side of the meter through holes in the side of the tray (A), or through mounting holes on tray tab (D) into tabs at the lower back edge of the meter (not shown).

##### 2.3.2 ADS-7

Plug meter into a four terminal socket. Provision should be made to short the leads to the current transformer in the event the meter is removed (socket with circuit closing device or otherwise).

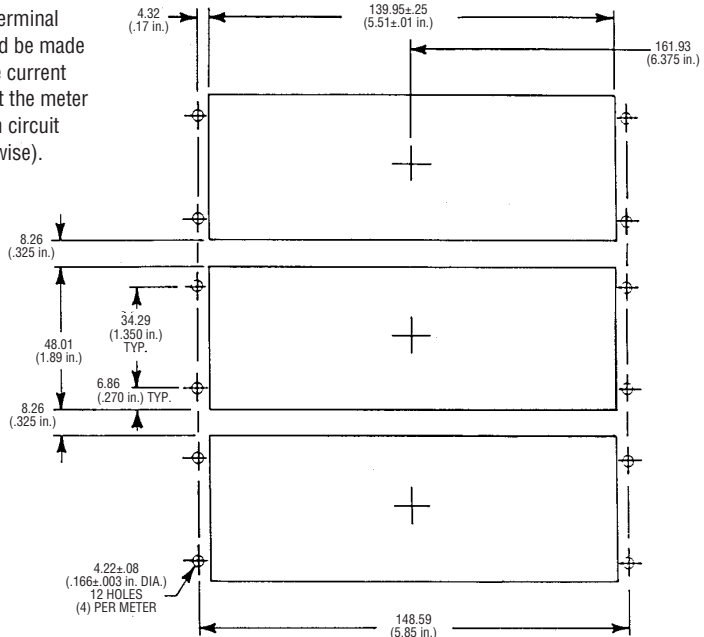


Figure 2.1 Panel Dimension for ADF-7

# AMPERE DEMAND METER

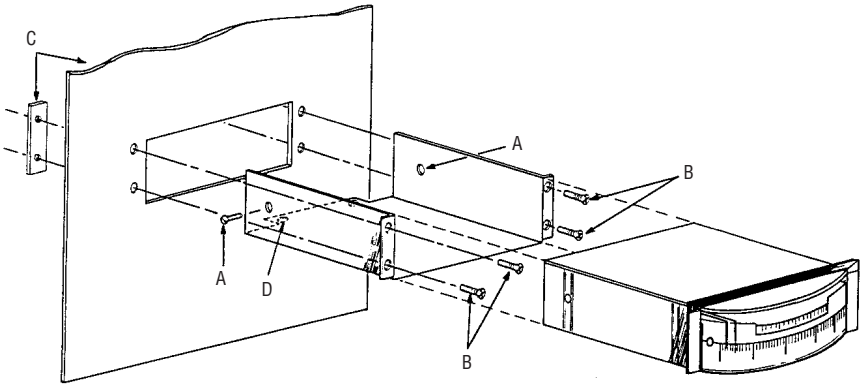


Figure 2.2 Installation of ADF-7

## SECTION 3

### PRINCIPLES OF OPERATION

The AD-7 thermal demand meter is optionally available with two selectable measurement ranges, and also an instantaneously reading ammeter. Additionally, units are available with instantaneous reading meters. Other units, either with or without instantaneous meters, are available with two selectable ranges of measurement.

Every AD-7 meter has a red pointer and a black pointer on the meter face. The red pointer on the demand scale indicates the present thermally time averaged current. The black pointer indicates the maximum thermally time averaged current the meter has experienced since last reset. On instantaneous ammeters, the red pointer on the instantaneous scale indicates the value of the instantaneous current (see Figures 3.1 and 3.2).

### 3.1 SETTING THE RANGE (DUAL-RANGE ONLY)

#### 3.1.1 ADF-7

Refer to Figure 3.1. Remove the white plug on the left side of the meter face and rotate the white screw head to obtain the desired multiplier. The multiplier will appear directly above the screw (multiplier is either 1 or 1/2, or 1 or 2). Replace the plug.

#### 3.1.2 ADS-7

Refer to Figure 3.2. Remove the meter cover and rotate the white screw on the right side of the meter face to obtain the desired scale multiplier (multiplier is either 1 or 1/2, or 1 or 2). Replace the meter cover.

### 3.2 CHANGING SCALES

**NOTE:** Refer to Figure 3.1. Choose scale with the same scale law number as the secondary rating scale in the meter, failure to use scales with the same scale law will adversely affect the accuracy of the meter.

#### 3.2.1 ADF-7

- Step 1 Remove two screws from the sides of meter (one from each vertical side).
- Step 2 Turn meter over and slide housing off.
- Step 3 Remove two screws from black plastic scale holder.
- Step 4 Pull scale holder from meter and change scales by sliding scale out of holder.

**NOTE:** Be sure that notch in the demand scale is placed to catch the plastic key in the holder. Also, instantaneous scale should be checked to see that the zero corresponds to the resting position of the pointer.

- Step 5 Reassemble meter.

#### 3.2.2 ADS-7

- Step 1 Remove two small screws from demand scale faceplate.
- Step 2 Remove plate.
- Step 3 Remove screws holding instantaneous scale in place and change scales.
- NOTE:** Take care not to damage pointer.
- Step 4 Reassemble meter.

### 3.3 RESET

#### CAUTION

When resetting the ADF-7 and the ADS-7, do not attempt to reset the red demand pointer to zero by using the black maximum demand pointer. Forcing the red demand pointer from an indicating position can damage the thermal mechanism.

#### 3.3.1 ADF-7

Use the demand reset actuator located on the right side of the meter face to reset the demand prior to a recording period. Pull reset - Simply pull the reset actuator out to reset the maximum demand pointer. Push reset - Simply push the reset actuator to reset the maximum demand pointer.

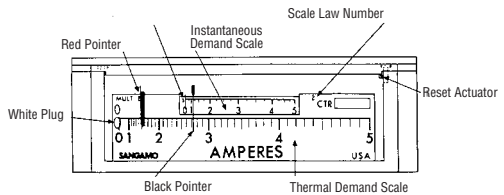


Figure 3.1 ADF-7

#### 3.3.2 ADS-7

Use the reset actuator in the cover to reset the demand prior to recording period. Simply turn the reset actuator counter-clockwise to reset the maximum demand pointer.

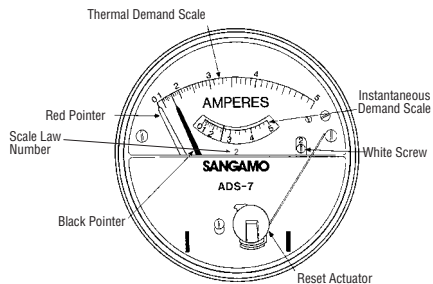


Figure 3.2 ADS-7

# AMPERE DEMAND METER

## SECTION 4

### THEORY OF OPERATION

The AD-7 meters utilize a thermal demand element that measures a continuous logarithmic average of the applied load. The maximum pointer registers 90% of the change in current over a specified interval of time. For a continuously applied current loading, the pointer will indicate 99.9% of that load in three response intervals. The time delay inherent in the demand meter is due to the time involved in the expansion and contraction of the thermal coil. Changes in ambient temperature are compensated for in the meter.

#### 4.1 RESPONSE OF THE ELEMENT

Time delay is inherent in all thermally sensing measuring devices. The thermal response to a given change in the sensed current is exponential in an ammeter. As a change in load occurs, the coil begins to accumulate additional heat. The coil then slowly causes a deflection of the shaft. This slow deflection continues until a stable state is reached between the heat given off by the coil and the heat lost to the surroundings by the enclosure. The time of this response is dictated by the heat storage capacity of the thermal element. This heat storage and transfer is dependent on the design of the different components (i.e., mass, specific heat of materials used, spacing of elements, and materials' shape.). The exponential response of an AD-7 demand ammeter is shown in Figure 4.1.

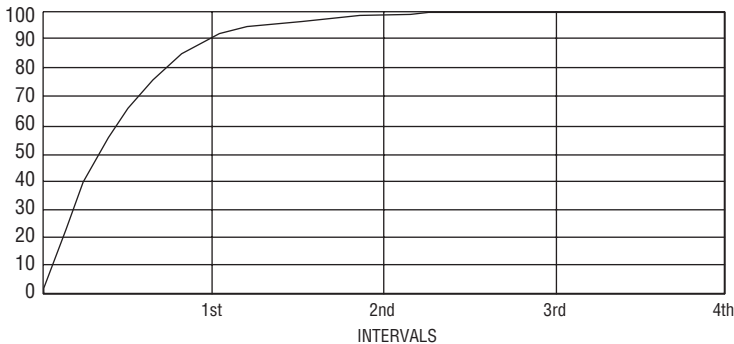


Figure 4.1 Response Intervals

The AD-7 meter uses a thermal demand element which measures a continuous logarithmic average of the applied load. The more recent the load, the greater the influence on the average. The demand pointer registers 90% of the change in the applied load over a demand interval. For a continuously applied load, the pointer will indicate 99.9% of that load in three response intervals. The thermal demand element has only one moving part and requires no lubrication, giving an inherent sustained accuracy which requires no periodic testing or maintenance.

Slight differences between meters and the inability to read great resolution from meter scales makes this thermal response accuracy greater than could be read.

A common misconception of the maximum demand thermal meter is that it only indicates 90% of the actual demand during any one interval. This is true only when the load is first introduced to the circuit.

After this the demand meter responds to 90% of the change in demand which produces a reading equal to a much larger percentage of the overall demand. Note Figure 4.2. At the end of the third interval, the meter has responded to 90% of the change between 6 and 9 ampere load but the meter reading of 8.69 is actually 96.4% of the overall demand.

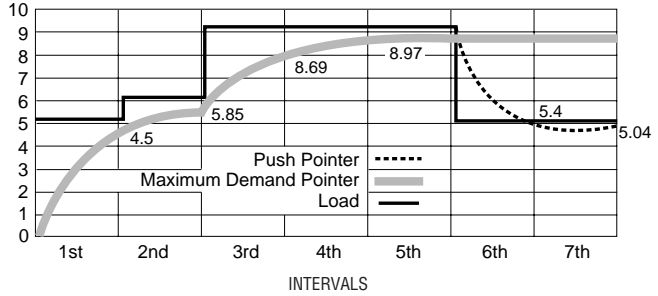


Figure 4.2 Demand Intervals

## SECTION 5 TESTING AND MAINTENANCE

The AD-7 is designed for maintenance-free service. Testing should only be necessary if the meter is suspected of inaccuracies due to mechanical or electrical failure. In this case, proceed as follows: **NOTE:** Ensure the AD-7 meter is in the upright position (as if it were mounted in socket or panel) for instantaneous meter testing. Test readings may be inaccurate in any other position.

- Step 1 Make zero adjustment by rotating entire thermal element assembly.
- Step 2 Series the meter to an AC current source (ideally) or an AC loading transformer. (If a transformer is used, an ammeter should be used to monitor the current going to the meter. Adjustments should be made during the testing to ensure a constant current.)
- Step 3 Test at full load for 25 minutes.
- Step 4 Full scale adjustment is made by turning the screw attached to the chain and spring inside meter. **NOTE:** Accuracy is expressed in terms of percent of full scale (for these meters:  $\pm 2\%$  of full scale).

### 5.1 TROUBLESHOOTING

#### PROBLEM

Meter suspected of inaccuracies

#### SOLUTIONS

1. The accuracy of the demand meter is  $\pm 2\%$  of the full scale value. Check to see that the differences in the reading are outside the deviation allowed for in this accuracy statement.
2. The meter should be installed level with the ground. Inaccuracies can occur, especially with the instantaneous meter, if the meter is not level.
3. Check to see if the meter is on the proper scale (dual range only).
4. Improper scale law used when installing primary reading scales will cause inaccuracies.

# AMPERE DEMAND METER

## SECTION 6

### REPLACEMENT PARTS AND DRAWINGS

#### 6.1 REPLACEMENT PARTS

The AD-7 series meters are designed so that entire subassemblies are replaced.

##### 6.1.1 ADF-7

Refer to Fig.6.1.1	Assembly	Part No.
1	Plug (meter face) . . . . .	.418346
2	Instantaneous ammeter . . . . .	.418357
3	Thermal element & housing assembly . . . . .	.418348
4	Internal current transformer:	
	5 amp . . . . .	.422679-002
	3 amp . . . . .	.422679-001
	6 amp . . . . .	.422679-003
	10 amp . . . . .	.422679-004
	2.5/5 amp . . . . .	.422678-002
	3/6 amp . . . . .	.422678-003
	5/10 amp . . . . .	.422678-005
not shown	Cover . . . . .	.418307
5	Maximum demand pointer and clutch assembly . . . . .	.418338
6	Dial shield (window) . . . . .	.422753
7	Mounting tray . . . . .	.418358
8	Reset actuator . . . . .	.418351
9	Spring (reset mechanism) . . . . .	.418345
not shown	Accessory kit . . . . .	.418347
	- terminal nuts (2)	- tray mtg. strap (2)
	- washers (2)	- meter mtg. screws (2)
	- tray mtg. screws (4)	

Primary reading scale kits are available.  
Consult the product bulletin or contact  
the factory for more information.

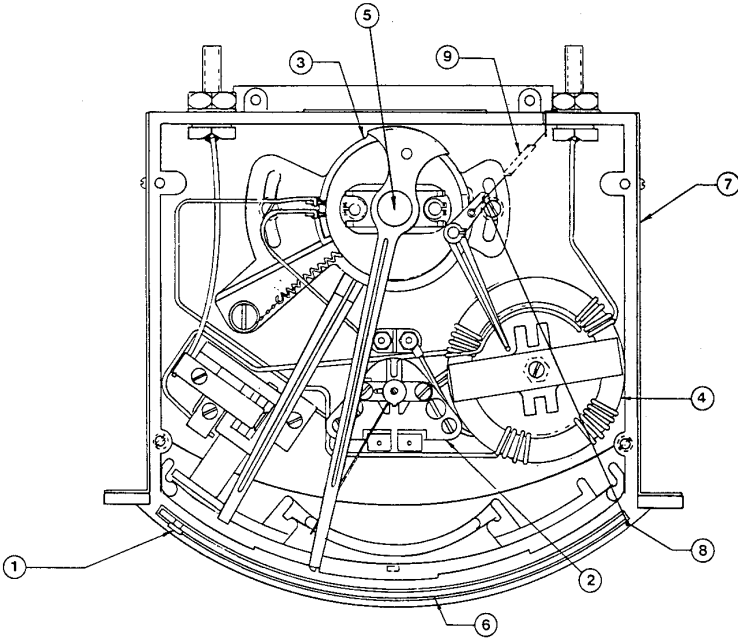
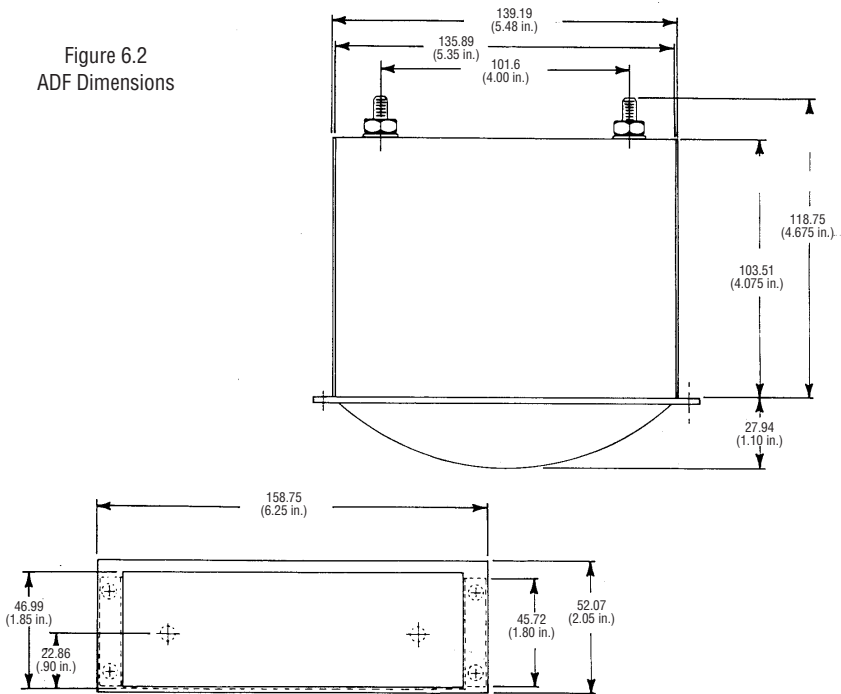


Figure 6.1.1 ADF Parts Assemblies

Figure 6.2 ADF Dimensions



# AMPERE DEMAND METER

## 6.1.2 ADS-7

Refer To Fig. 6.3.1	Assembly	Part No.
1	Thermal element & housing assembly	418354
not shown	Internal current transformer:	
	5 amp	418353-009
	3 amp	418353-004
	1.5 amp	418353-010
	6 amp	418353-005
	4/8 amp	418353-007
	10 amp	418353-006
	2.5/5 amp	418353-001
	1.5/3 amp	418353-008
	3/6 amp	418353-002
	5/10 amp	418353-003
not shown	Maximum demand pointer and clutch assembly	418377
not shown	Cover	418379
2	Instantaneous ammeter	418357

Primary reading scale kits are available. Consult the product bulletin or contact the factory for more information.

## 6.2 DRAWINGS

Refer to Figures 6.2 and 6.4 for ADF and ADS dimensions. Figures 6.5 through 6.12 are wiring diagrams for the various ADF and ADS configurations.

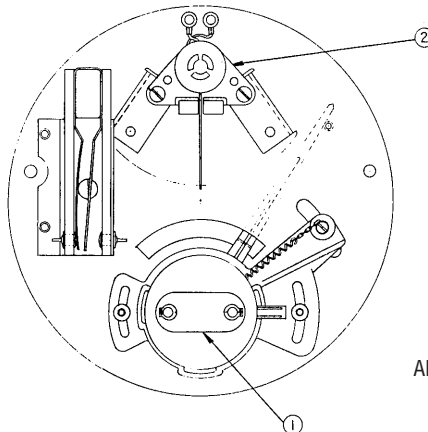


Figure 6.3.1  
ADS Parts Assemblies

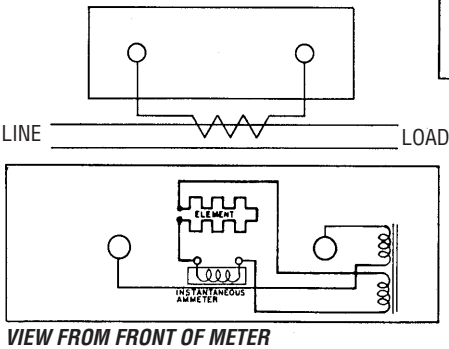
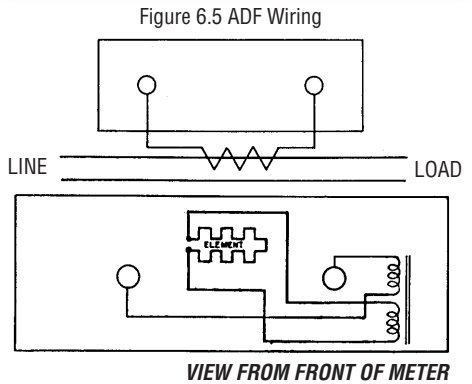
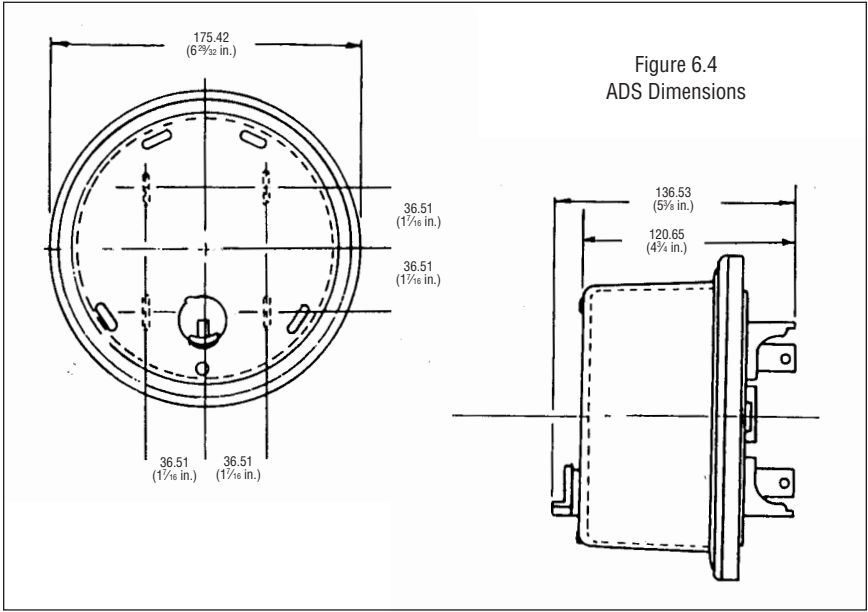


Figure 6.6

ADF with Instantaneous Ammeter Wiring

# AMPERE DEMAND METER

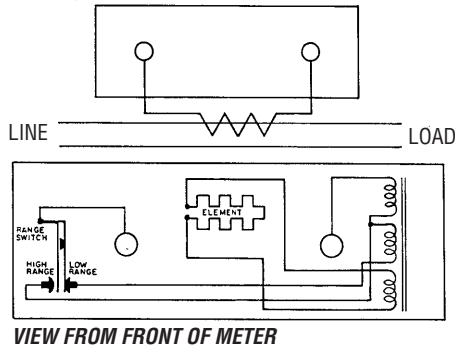


Figure 6.7  
Dual Range ADF Wiring

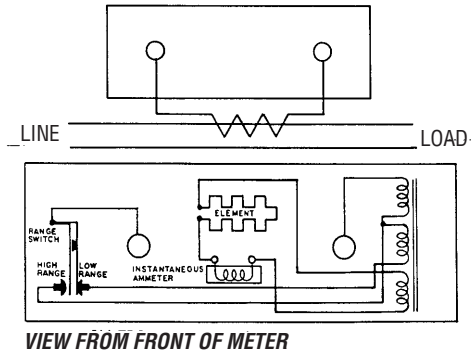


Figure 6.8  
Dual Range ADF with  
Instantaneous Ammeter Wiring

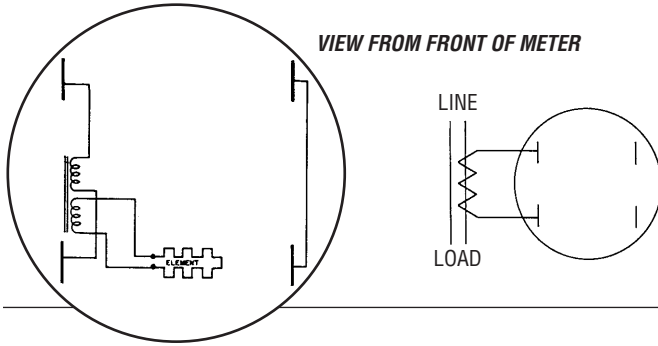


Figure 6.9  
Single Range ADF  
Wiring

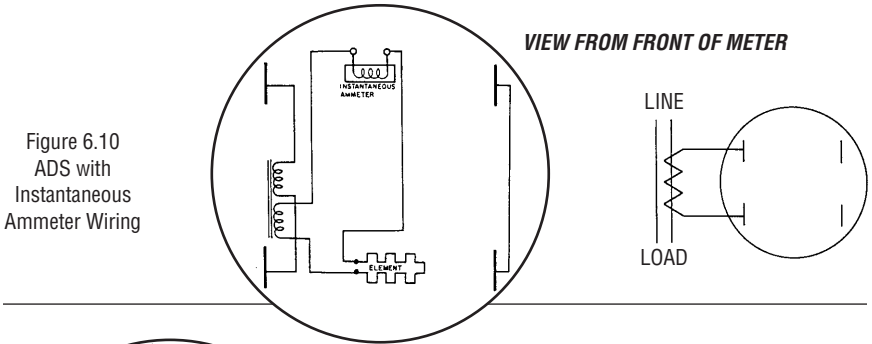


Figure 6.10  
ADS with  
Instantaneous  
Ammeter Wiring

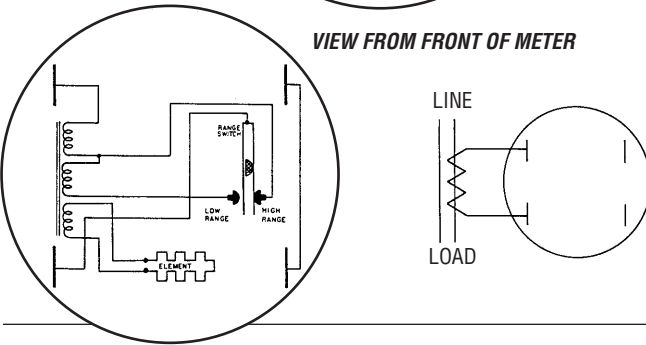


Figure 6.11  
Dual Range ADS Wiring

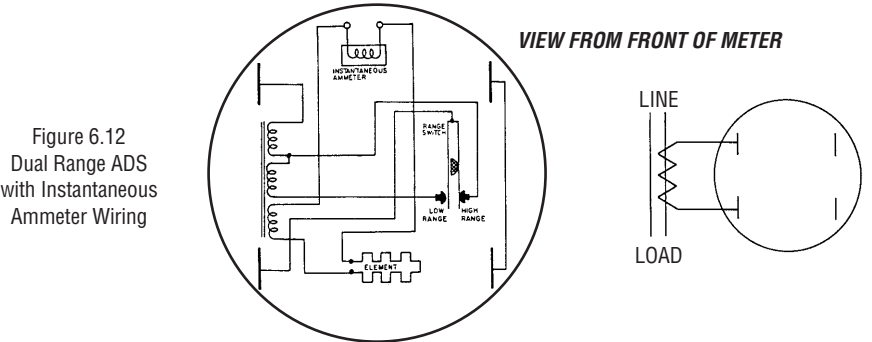


Figure 6.12  
Dual Range ADS  
with Instantaneous  
Ammeter Wiring

## **LIMITATION OF WARRANTY AND LIABILITY**

NOTICE: READ THIS LIMITATION OF WARRANTY AND LIABILITY BEFORE BUYING OR USING THIS PRODUCT. IF THE TERMS ARE NOT ACCEPTABLE, RETURN THE PRODUCT AT ONCE, AND THE PURCHASE PRICE WILL BE REFUNDED.

It is impossible to eliminate all risks associated with the use of this product. Risks of serious injury or death, including risks associated with electrocution, arcing and thermal burns, are inherent in work in and around energized electrical systems. Such risks arise from the wide variety of electrical systems and equipment to which this product may be applied, the manner of use or application, weather and environmental conditions or unknown factors, all of which are beyond the control of HD Electric Company.

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