Electro Industries/GaugeTech
"The Leader in Web Accessed Power Monitoring and Control"

DWVA 300 and DWVV 300

Solid State Digital Triple Display Multi-Function Power Monitoring System

Installation, Operation and Programming Manual

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PROGRAMMING YOUR DWVV

INSTALLATION & OPERATION

CHAPTER 1
AC Power Measurement

The economics of electric power distribution networking dictated several configurations of AC power transmission. These configurations are characterized by the number of phases and levels of voltages of the system.

1.1 Single Phase System

The single phase system is a basic two wire system used in low power distribution applications, such as residential communities or offices. Typically, the voltage of the two wire system is 120V AC.

For higher power requirements, such as residential houses or small commercial facilities, the typical power configuration is two lines of 120V AC opposite in phase (See figure 1.1 B).

This system produces 120 volts from line to neutral for lighting and small appliances use. The line to line voltage is 240V AC, used for higher loads such as water heaters, electric dryers, ranges, and machinery.

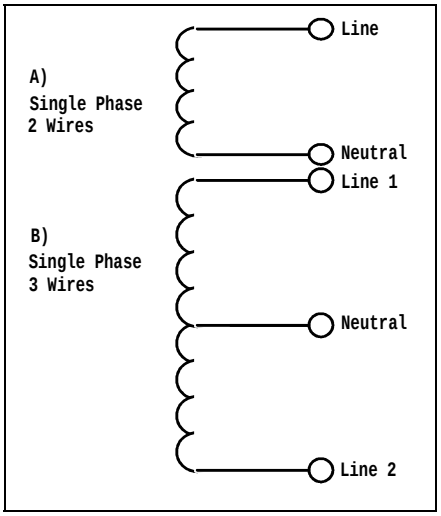


Figure 1.1
Single Phase System: (A) Two Wire
(B) Three Wire

The power (**W)** in a single phase system is defined as: $W = E \cdot I \cdot \cos\Theta$
E = potential, **I** = current, and **cosΘ** = phase difference between the potential and the current.

Power in a 120/240V AC system is: $W = (E_{Line\,1} \cdot I_{Line\,1} \cdot \cos\Theta) + (E_{Line\,2} \cdot I_{Line\,2} \cdot \cos\Theta)$

Phase differential between the potential and the current results from a non-resistive load, either reactive or capacitive.

Reactive power **VAR** - The additional power consumed, that does not produce any work, but must be delivered to the load: $VAR = E \cdot I \cdot \sin\Theta$. This is a measure of the inefficiency of the electrical system.

Apparent power **VA** - The total power delivered to the load, and vector sum of real power and reactive power. Figure 1.2 shows a triangle which is a graphic representation of the relationships between apparent, real, and reactive power.

Power Factor **PF** - The ratio between real power and apparent power: $PF = \frac{W}{VA} = \frac{W}{\sqrt{W^2 + VAR^2}}$

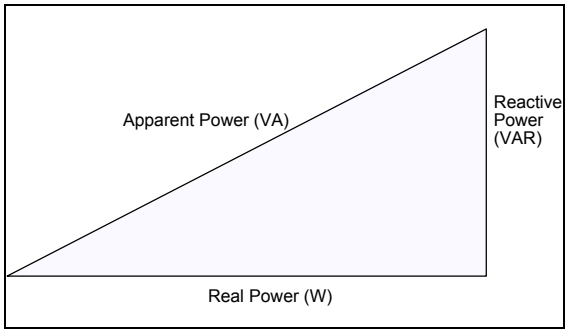


Figure 1.2
Relationship between apparent, real and reactive power.

Ideal power distribution should have a PF of 1. This condition could be met only if there are no reactive power loads exist. In real life applications, many of the loads are inductive loads. Often, corrective capacitors are installed to correct poor Power Factor.

1.2 Three Phase System

THREE PHASE SYSTEM: Delivers higher levels of power for industrial and commercial applications; the three phases correspond to three potential lines. There is a 120° phase shift between the three potential lines.

A typical configuration has either a Delta connection or a Wye connection. (See Figure 1.3).

In a three phase system, the voltage levels between the phases and the neutral are uniform and defined by:

$$E_{an} = E_{bn} = E_{cn} = \frac{E_{ab}}{\sqrt{3}} = \frac{E_{bc}}{\sqrt{3}} = \frac{E_{ac}}{\sqrt{3}}$$

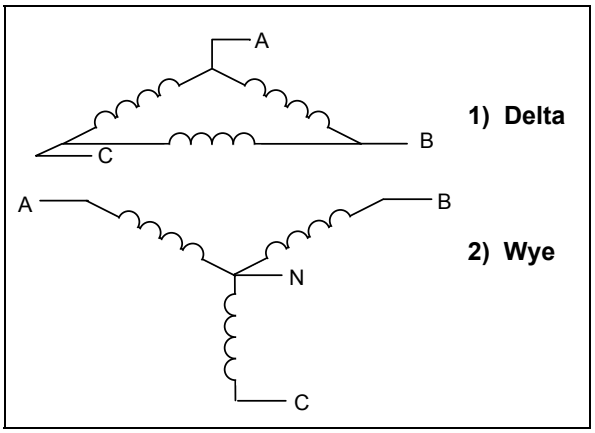


Figure 1.3
Three Phase System: 1) Delta
2) Wye

Voltages between the phases vary depending on loading factors and the quality of the distribution transformers. The three phase system is distributed in different voltage levels: 208V AC, 480V AC, 2400V AC, 4160V AC, 6900V AC, 13800V AC, and so on.

Power measurement in a poly phase system is governed by Blondel's Theorem. **Blondel's Theorem** states that in a power distribution network which has N conductors, the number of measurement elements required to determine power is N-1.

A typical configuration of poly phase system has either a Delta connection or a wye Connection. (See Figure 1.4).

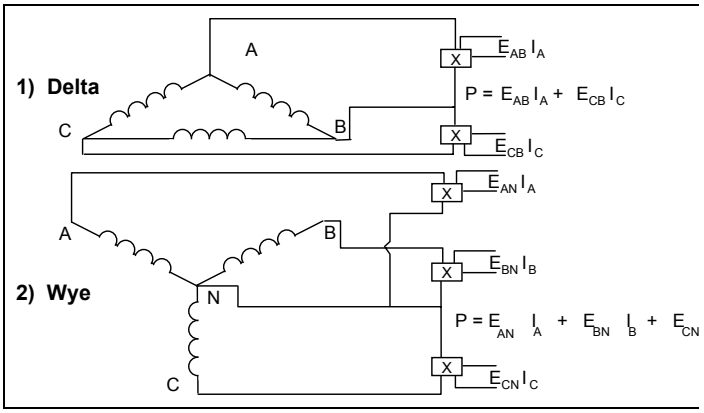


Figure 1.4
Poly Phase System: 1) Delta
2) Wye

1.3 Consumption, Demand and Power Factor Losses

The total electric energy usage over a period of time is the consumption **WH**.
Consumption is: $WH = W \cdot T$ **W** = instantaneous power **T** = time in hours

Typically, the unit in which consumption is specified is the kilowatt-hour (KWH). **KILOWATT-HOUR**: one thousand watts consumed over one hour. Utilities use the **WH** equation to determine the overall consumption in a billing period.

DEMAND: Average energy consumed over a specified time interval. The interval is determined by the utility; typically 15 or 30 minutes. The utility will measure the maximum demand over a billing period. This measurement exhibits a deviation from average consumption causing the utility to provide generating capacity to satisfy a high maximum consumption demand.

Poor Power Factor results in reactive power consumption. Transferring reactive power over a distribution network causes energy loss. To force consumers to correct their power factor, utilities sometimes monitor reactive power consumption and penalize the user for poor Power Factor.

1.4 Waveform and Harmonics

Ideal power distribution has sinusoidal wave forms on voltages and currents. In real life application, where inverters, computers, and motor controls are used, distorted wave forms are generated. Those distortions consist of harmonics of the fundamental frequency.

SINUSOIDAL WAVEFORM: $A \cdot \sin(\omega \cdot t)$

DISTORTED WAVEFORM: $A \cdot \sin(\omega \cdot t) + A_1 \cdot \sin(\omega_1 \cdot t) + A_2 \cdot \sin(\omega_2 \cdot t) + A_3 \cdot \sin(\omega_3 \cdot t) + \cdots$

TOTAL HARMONIC DISTORTION (THD):

$$\%\ of\ THD = \frac{RMS\ of\ Total\ Harmonic\ Distortion\ Signal}{RMS\ of\ the\ Fundamental\ Signal} \times 100$$

HARMONIC DISTORTION: A destructive force in power distribution systems. It creates safety problems, shortens the life span of distribution transformers, and interferes with the operation of electronic devices.

CHAPTER 2
Mechanical Installation

These diagrams display the various possible DWVA and DWVV mechanical installations and Communication Converter installation.

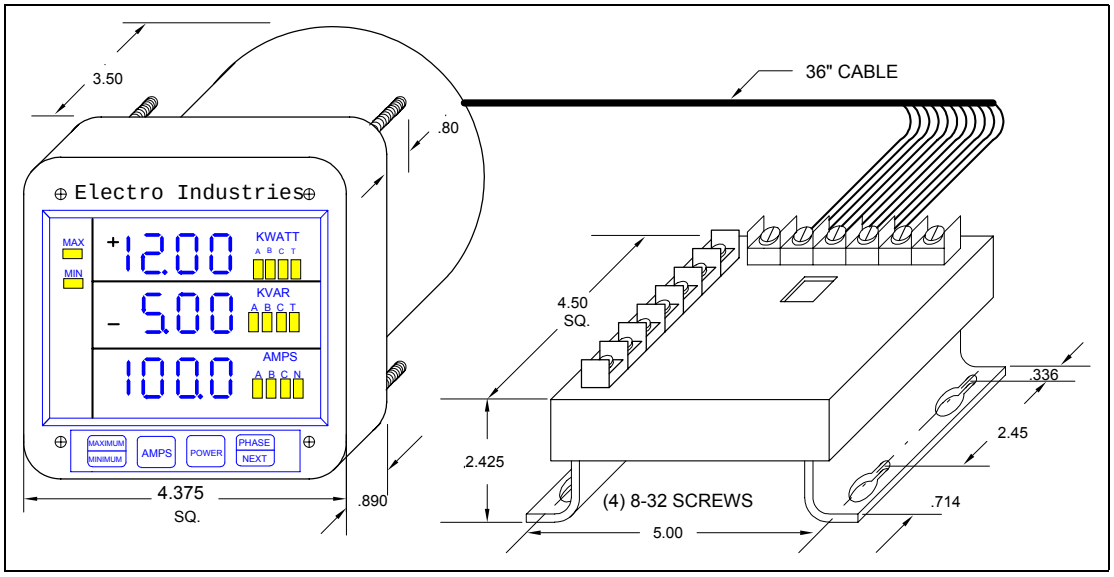


Diagram 2.1: Installation of the DWVA (or DWVV) with K-110 Option for limited space conditions.

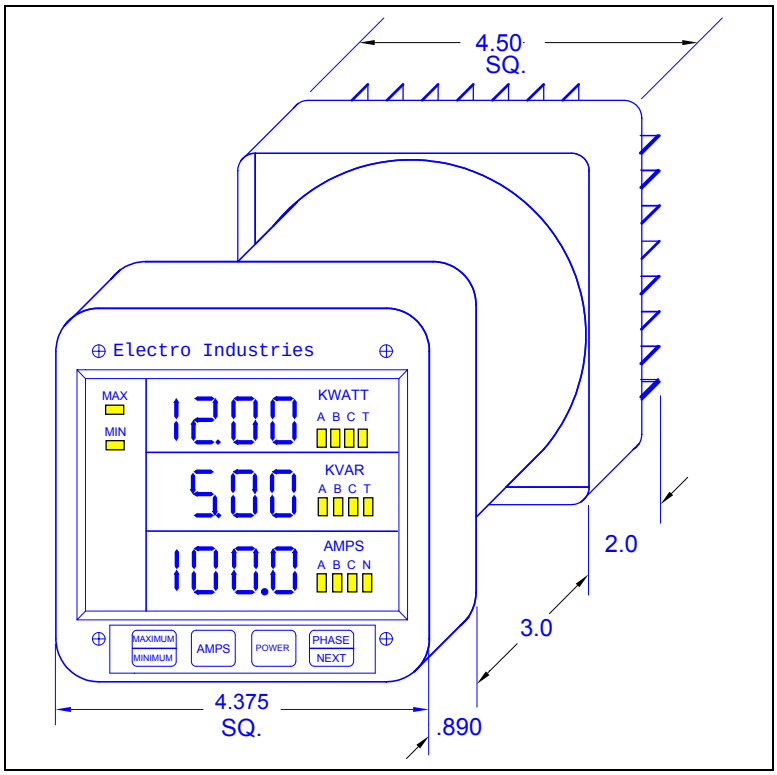


Diagram 2.2: Standard Installation of the DWVA (or DWVV).

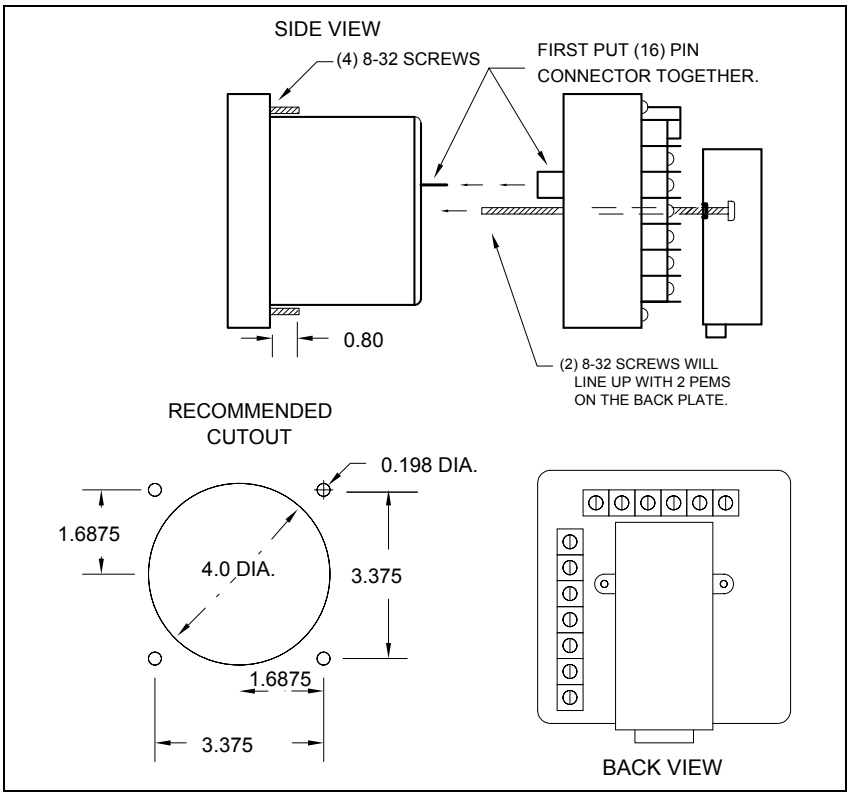


Diagram 2.3: Standard cutout for DWVA (or DWVV).

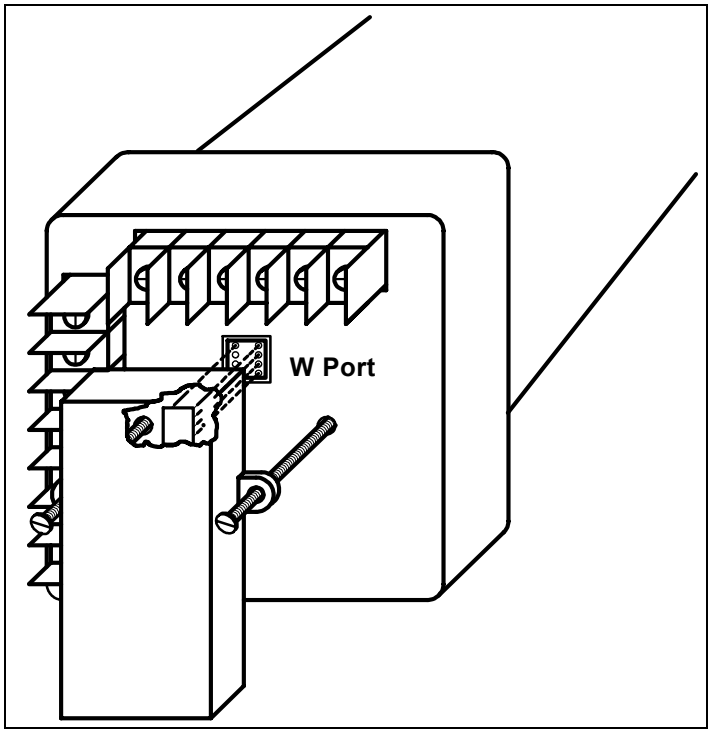


Diagram 2.4: Optional Communication Converter or DC Output Module Installation

NOTE: Carefully line up the guide screw and the 8-pin port connector to prevent pin breakage.

CHAPTER 3
Electrical Installation

3.1 Connecting the Current Circuit

The cable used for the current should be installed at 600V AC minimum. The cable connector should be rated at 6 Amps or greater and it should have a cross-sectional area of 16 AWG.

Mount the current transformers as close as possible to the meter. The following table illustrates the maximum recommended distances for various CT sizes, assuming the connection is made via 16 AWG cable.

CT SIZE (VA)	MAXIMUM DISTANCE (CT TO DWVA, DWVV)
2.5 VA	10 FEET
5.0 VA	15 FEET
7.5 VA	30 FEET
10.0 VA	40 FEET
15.0 VA	60 FEET
30.0 VA	120 FEET

WARNING: DO NOT leave secondary of CT when primary current is flowing. This may cause a high voltage, which overheats the secondary of the CT. If the CT is not connected, provide a shorting block on the secondary of the CT.

3.2 CT Connection

If the DWVA and DWVV meters are connected directly, maintain the exact connection to avoid incorrect polarity.

When the DWVA or DWVV is connected using the CT's, it is imperative to maintain the correct CT polarities. CT polarities are dependent upon correct connections of CT leads and the direction that the CT's are facing when clamped around conductors. The dot on the CT must face the line side and the corresponding secondary connection must connect to the appropriate pin.

NOTE: CT's are shorted if connected to the terminal block model DSP2, even if it detached from the meter.

3.3 Connecting the Voltage Circuit

For proper operation, the voltage connection *must* be maintained and must correspond to the correct terminal.

The cable required to terminate the voltage sense circuit should have an insulation rating greater than 600V AC and a current rating greater than 0.1 A.

3.4 Selecting the Voltage Fuses

We recommend using fuses, although connection diagrams do not show them. Slow blow, 200mA rating fuses should be used.

The maximum voltage the DWVA or DWVV can handle is 150V Phase to Neutral. Suffix -G extends the maximum voltage to 300V Phase to Neutral.

3.5 Connection to the Main Power Supply

The DWVA and DWVV meters require a separate power supply. Listed are the 5 different power supply options and corresponding suffixes.

POWER SUPPLY OPTIONS	SUFFIXES	CURRENT
120V AC	NO SUFFIX	.1 AAC
240V AC	A	.05 AAC
24V DC	D	.5 ADC
48V DC	D1	.25 ADC
125V DC	D2	.1 ADC

NOTE: For DC-powered units, polarity must be observed. Connect the negative terminal to L1 and positive terminal to L2. An earth to ground connection to chassis is mandatory for normal operation (terminal three). Do not ground the unit through the negative of the AC supply. SEPARATE grounding is required.

3.6 Electrical Connection Installation

Choose the diagram that best suits your application and maintain the polarity. Follow the outlined procedure to verify correct connection.

To verify polarity, all phases of KW should be positive, if not reverse the CT wires only when the system is shut down. See section 5.1 to view KW phases.

LISTING OF CONNECTION DIAGRAMS

NOTE: ALL DRAWINGS APPLY TO DWVA AND DWVV, EXCEPT #6 (DWVA-250 ONLY).

I Three-Phase, Three-Wire System Delta with Direct Voltage and CT's.

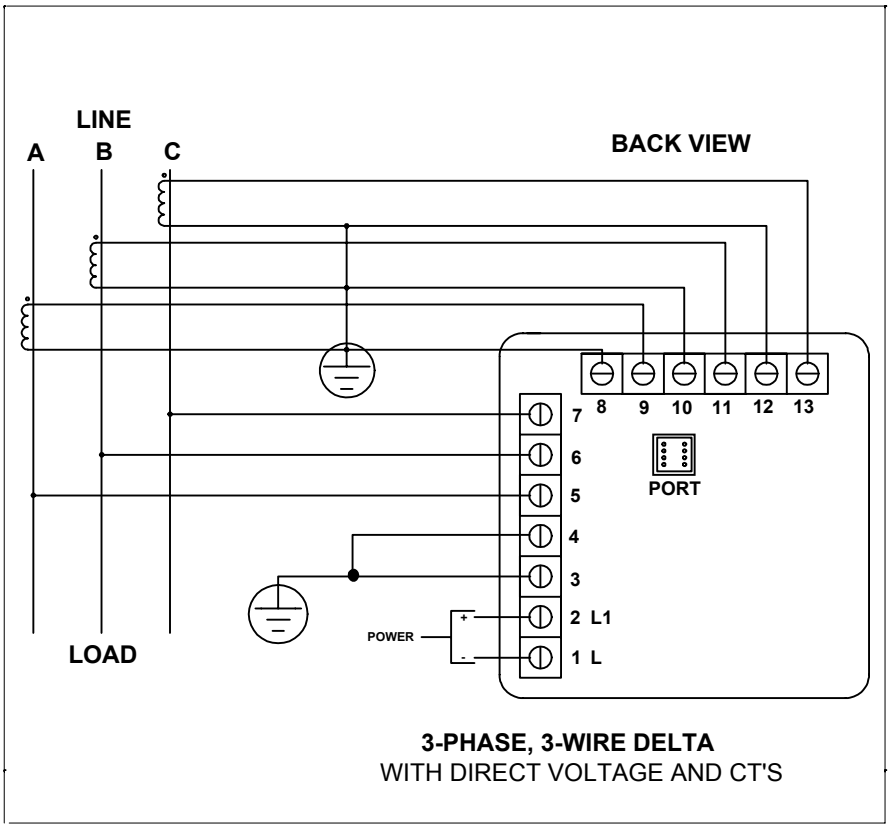
II Three-Phase, Three-Wire Open Delta with two CT's and two PT's.
Open Delta System Installation should only be used if the electrical system is a 3-wire OPEN DELTA. Single Phase for the Open Delta configuration is not available. Open Delta can be enabled or disabled in Programming GROUP 0, FUNCTION 3.

III Three-Phase, Three-Wire Open Delta with three CT's and two PT's.
Open Delta System Installation should only be used if the electrical system is a 3-wire OPEN DELTA. Single Phase for the Open Delta configuration is not available. Open Delta can be enabled or disabled in Programming GROUP 0, FUNCTION 3.

IV Three-Phase, Four-Wire System Wye with Direct Voltage and CT's.

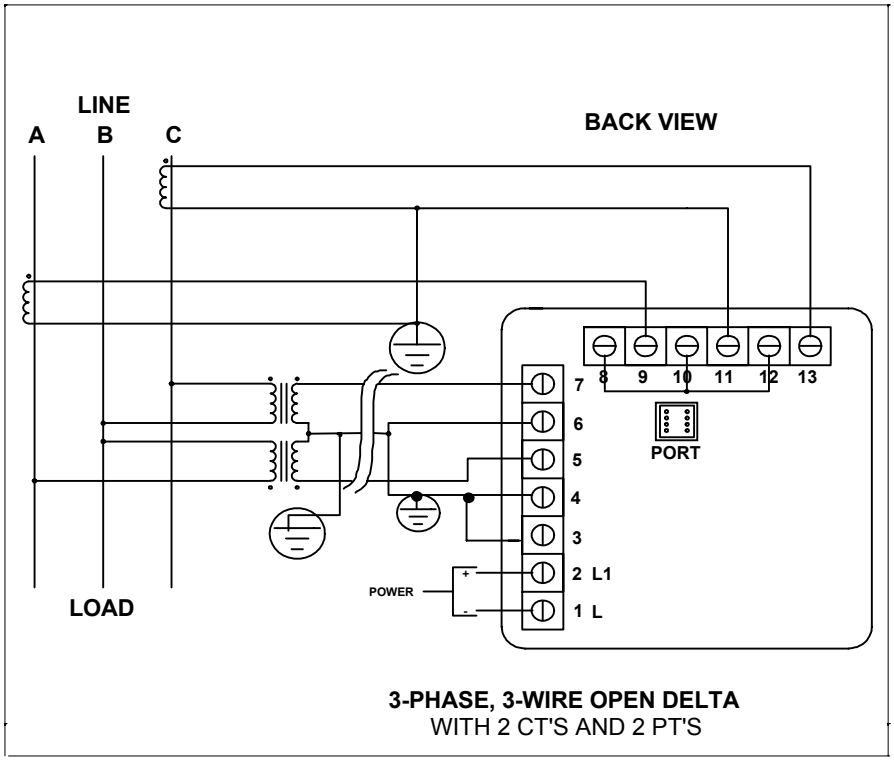
V Three-Phase, Four-Wire System Wye with CT's and PT's.

VI Three-Phase, Four-Wire System Wye 2½ Element with CT's and PT's. (DWVA-250 only)



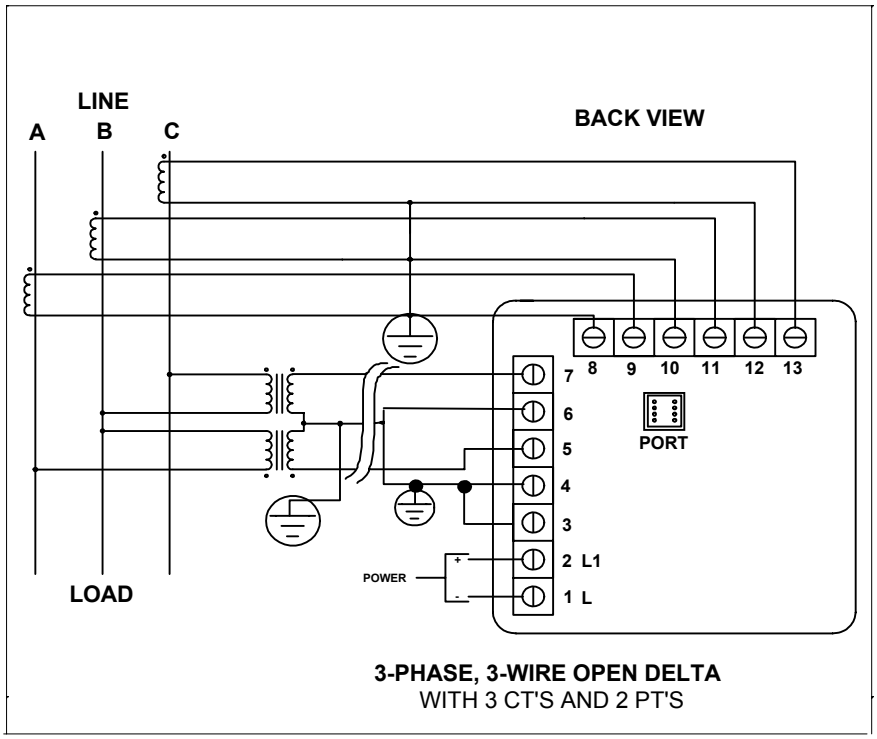
3-PHASE, 3-WIRE DELTA
WITH DIRECT VOLTAGE AND CT'S

I. Three Phase System



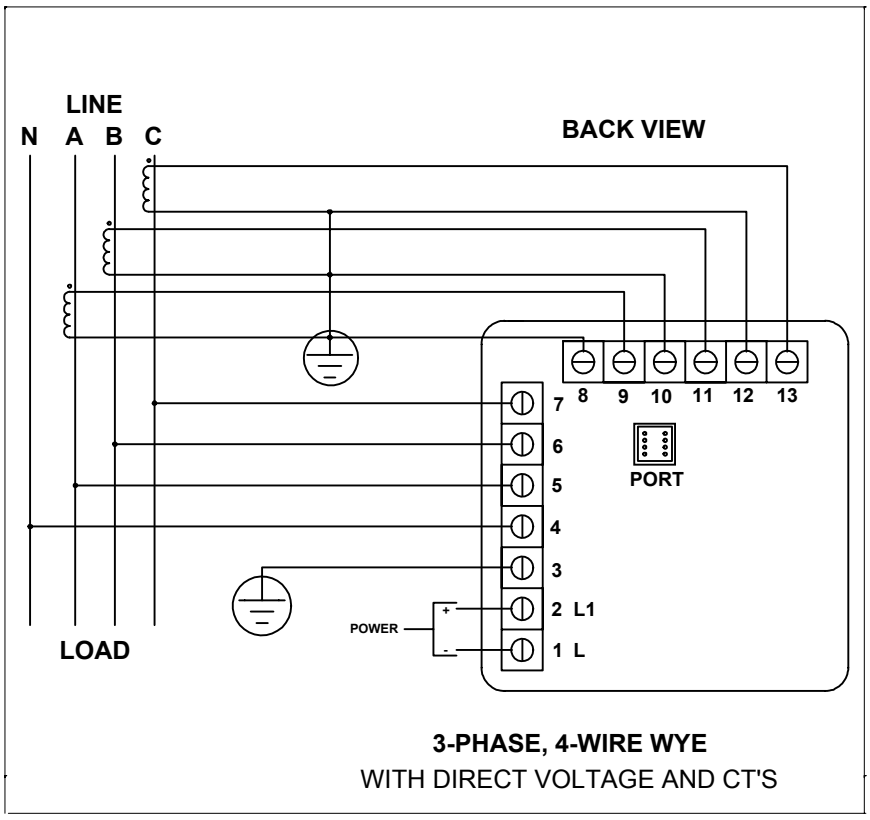
3-PHASE, 3-WIRE OPEN DELTA
WITH 2 CT'S AND 2 PT'S

II. Open Delta System Installation *Special programming required.*



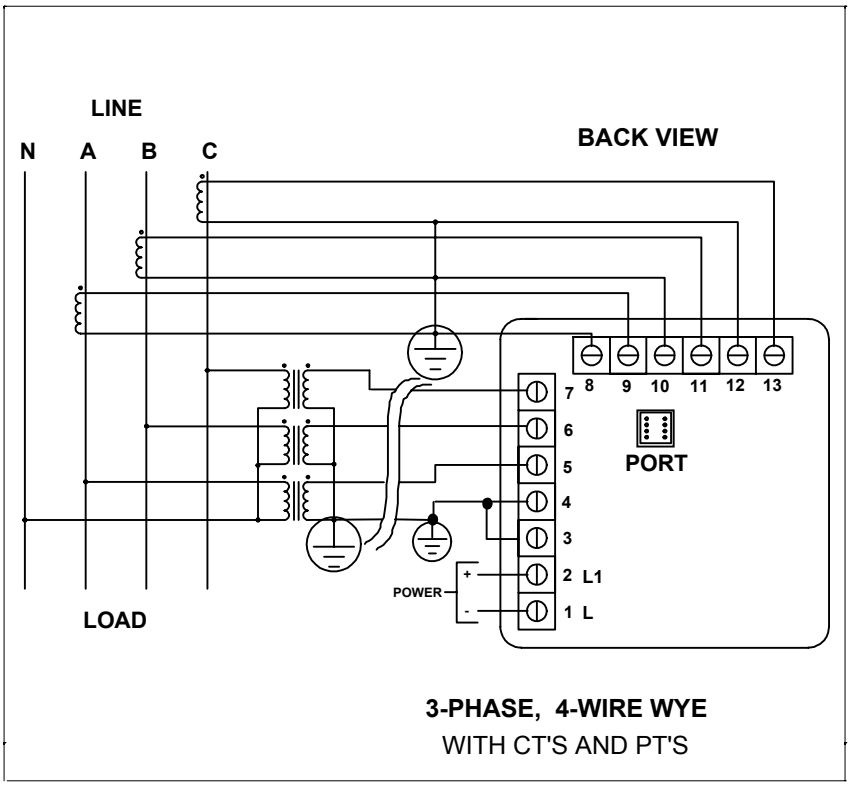
3-PHASE, 3-WIRE OPEN DELTA
WITH 3 CT'S AND 2 PT'S

III. Open Delta System Installation Special programming required.

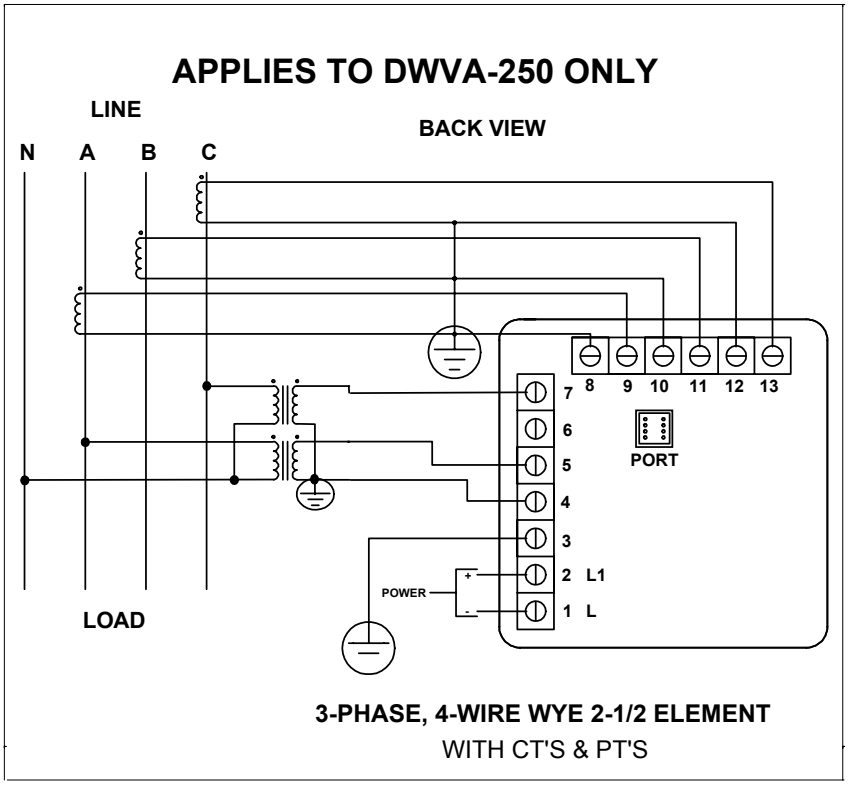


3-PHASE, 4-WIRE WYE
WITH DIRECT VOLTAGE AND CT'S

IV. Three Phase System



V. Three Phase System



VI. Three Phase System

CHAPTER 4
Communication Installation

4.1 RS-232C

All the DWVA and DWVV instruments can be equipped with: the EIA RS-232C or the EIA RS-485.

RS-232C communication links a single instrument with a computer. Its capability is up to 100 feet. A standard 9-pin female serial port connector mounts on the instrument for direct connection to a computer with a 9-pin cable.

NOTE: Only three pins are used in RS-232C (See Figure 4.1).

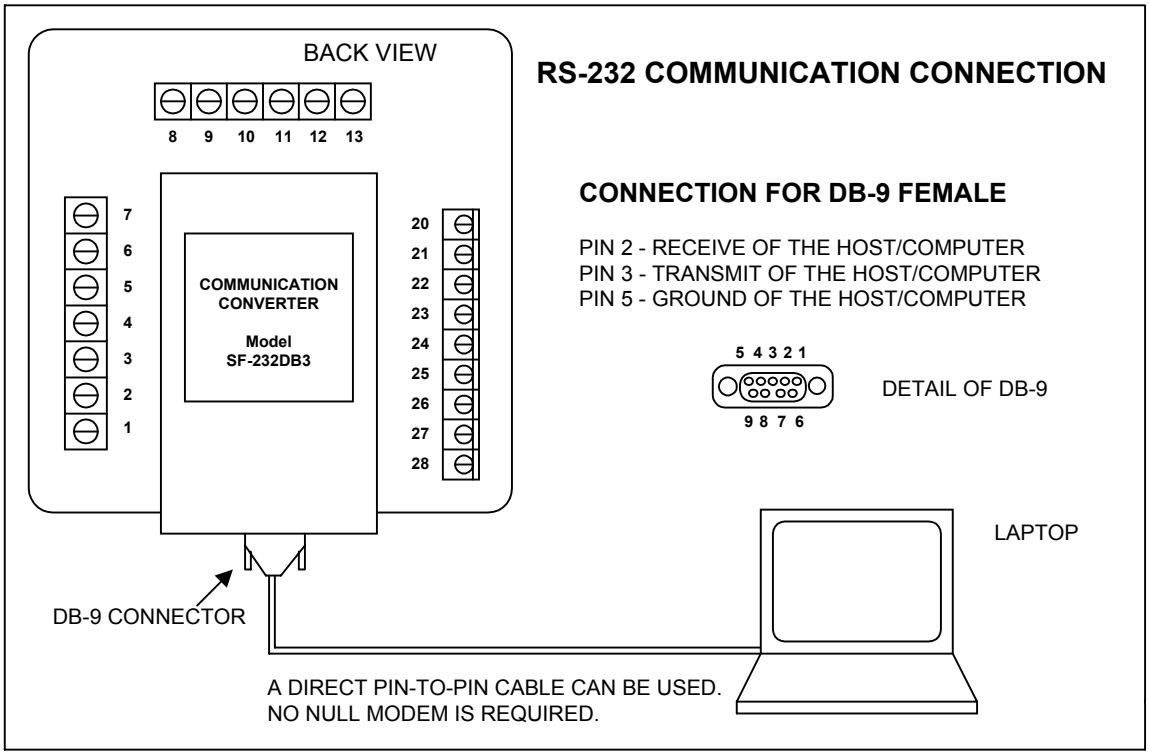


Figure 4.1: RS-232C Communication Connection Installation

4.2 RS-485

Each DWVA or DWVV instrument has a unique address up to four digits long. This allows the user to communicate with up to 10,000 instruments. Available standard baud rates are up to 9600 baud. To select the proper baud rate, apply the following rules:

The unit operates up to 9600 baud. For smaller number of instrument over long distance, use a lower baud rate. Optimal recommended baud is 1200 baud if noisy conditions exist.

RS-485 is used to parallel multiple instruments on the same link. Its operating capability is up to 4000 feet.

- When only 2 wires are used (on the RS-485), the link can include up to 30 instruments (See Figure 4.2).
- When all four wires are used, the link can include up to 60 instruments (See Figure 4.3).

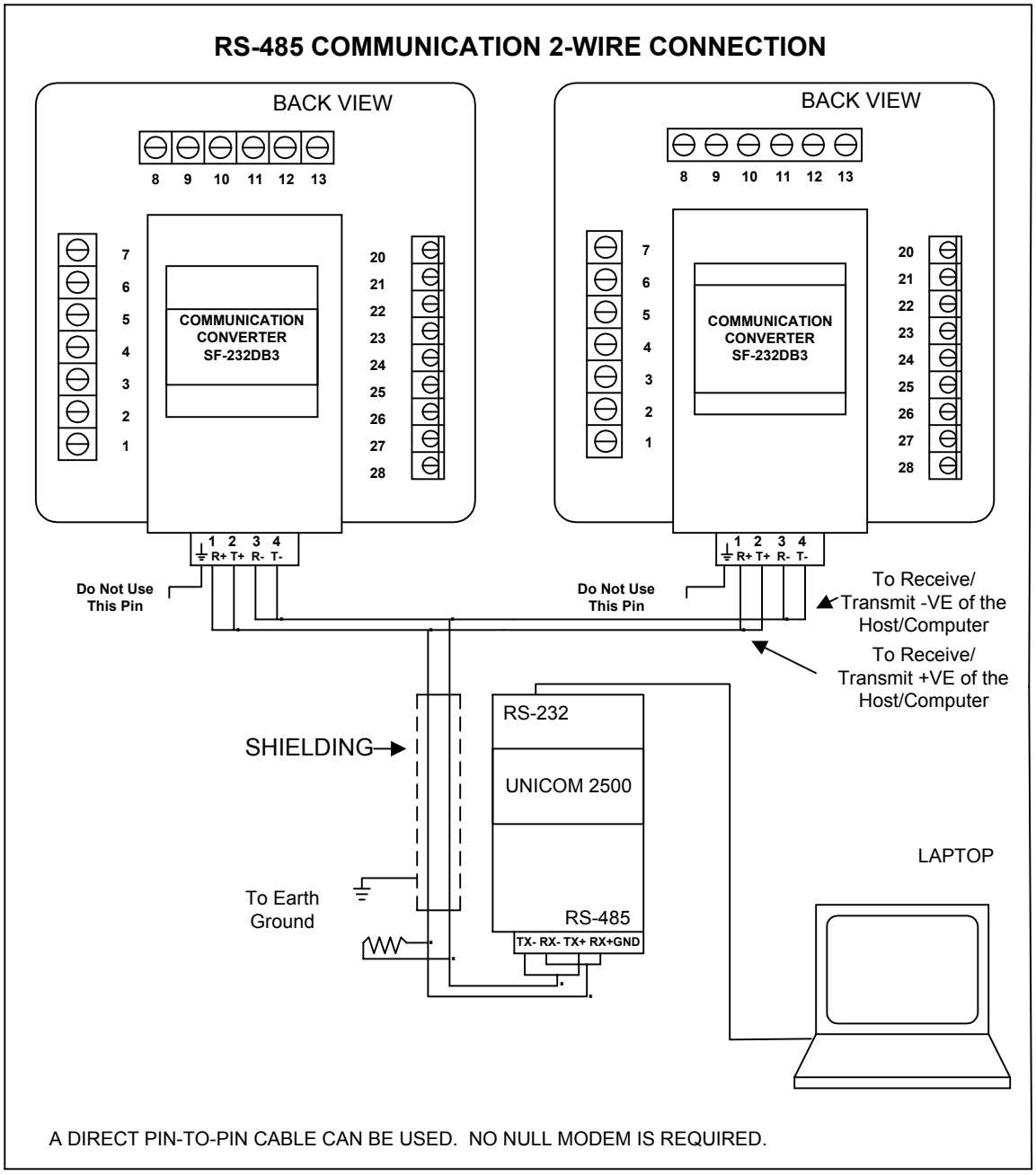


Figure 4.2: 2-Wire RS-485 Communication Hookup Installation

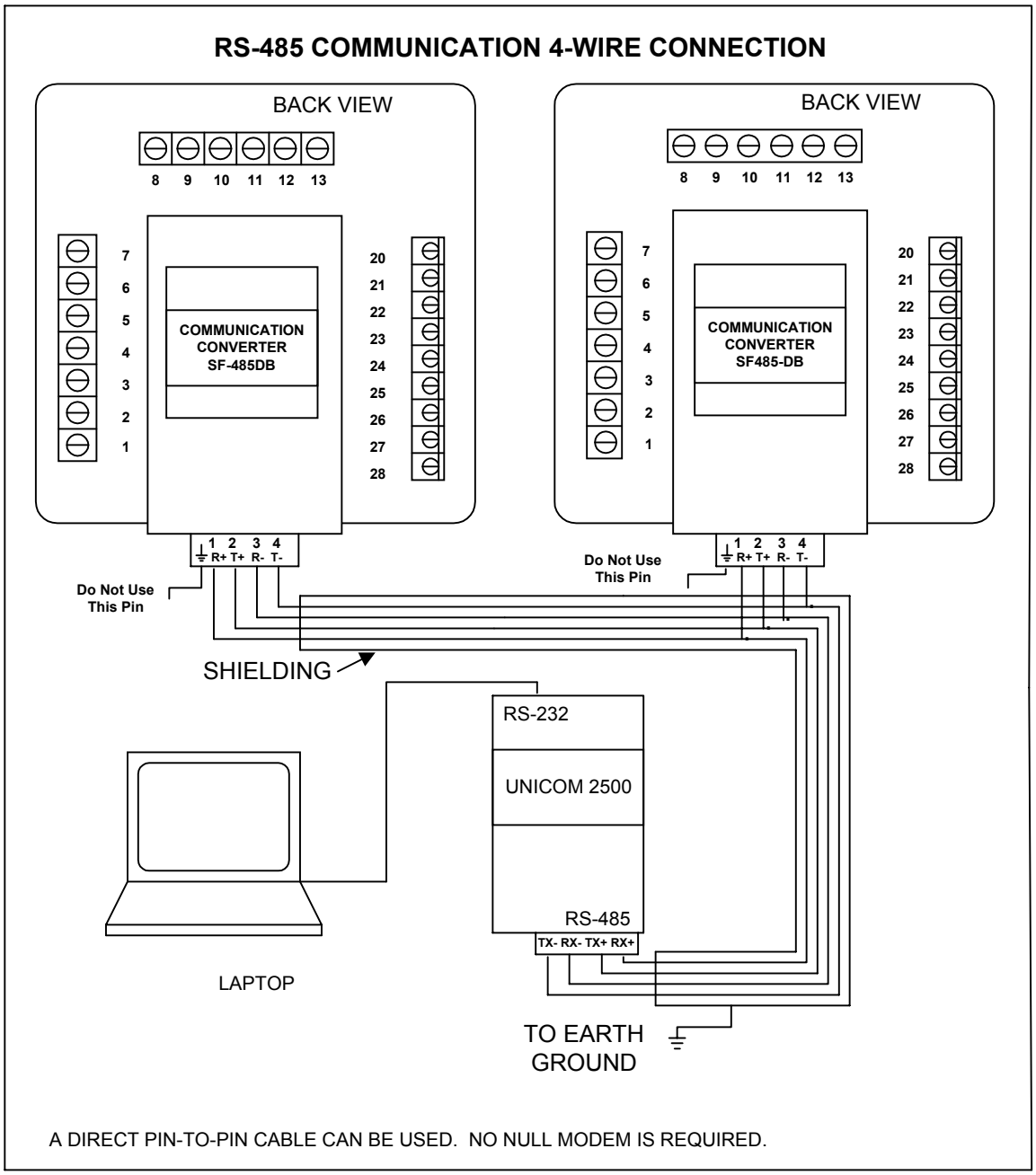


Figure 4.3: 4-Wire RS-485 Communication Connection Installation

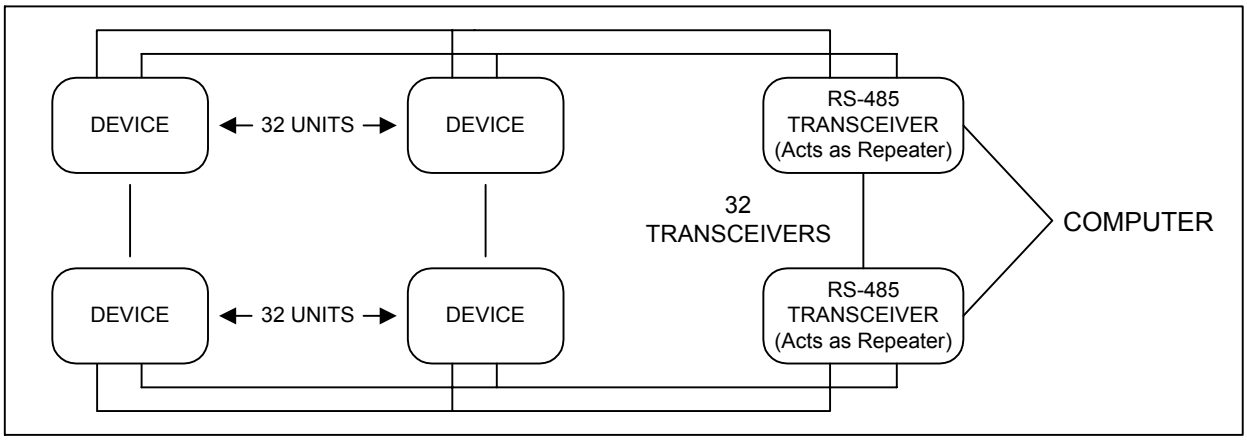


Figure 4.4: 2-Wire RS-485 Communication Installation Connection with Transponder

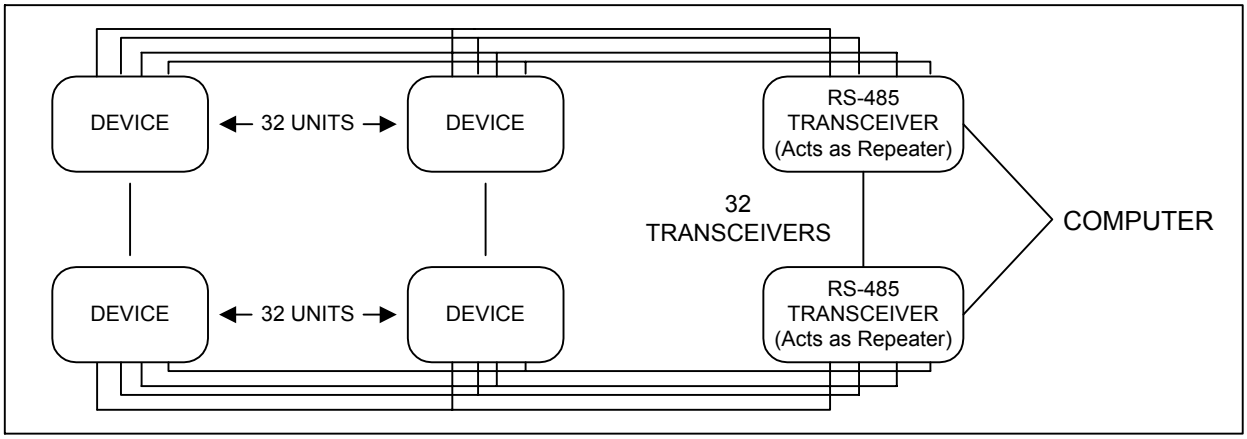


Figure 4.5: 4-Wire RS-485 Communication Installation Connection with Transponder

4.3 Network of Instruments and Long Distance Communication

For a large network of instruments, the RS-485 Transponder is required.

- In a two-wire connection, a maximum of 900 instruments can be included in the same network (See Figure 4.4).
- In a four-wire connection, a maximum of 3600 instruments can be included in the same link (See Figure 4.5).

Use modems (dedicated or dial-up) when the instruments are located at great distances. However, set the modem to auto answer at the recommended value of 1200 baud rate if noise conditions exist.

CHAPTER 5
DWVA: An Overview

The DWVA meter is detailed in Chapters 5 – 12. The DWVV meter is detailed in Chapters 13 – 20.
The DWVA reads up to 12 electrical parameters. Values for each parameter are accessed through the keypad.

AMPS	POWER
A	± KWATT A, B, C
B	± KVAR A, B, C
C	± TOTAL KWATT ±TOTAL KVAR
N	

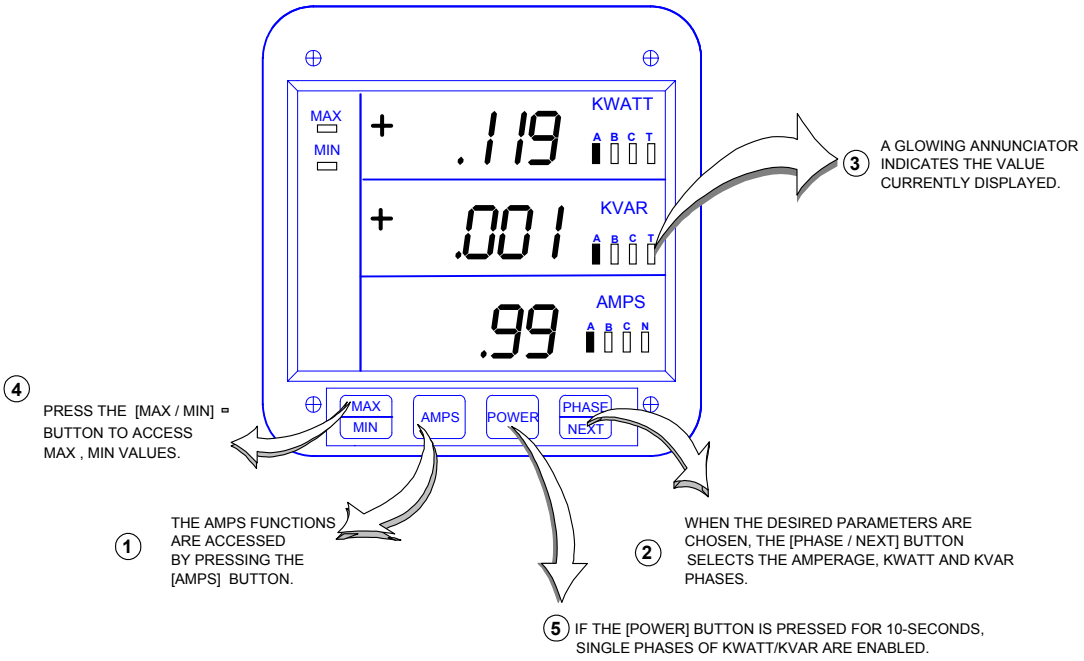
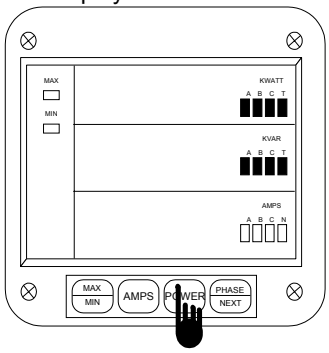


Diagram 5.1: The DWVA front panel with display and keypad.

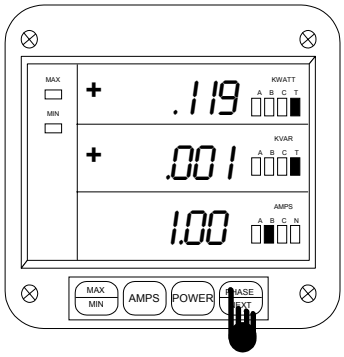
5.1 Accessing KW/KVAR Single Phases

Start with a blank display.



Step 1:
a. Press ***POWER*** for 10 seconds to view single phases for KW and KVAR.

⇨The display blanks and all annunciators in the KW and KVAR section glow, confirming the selection.

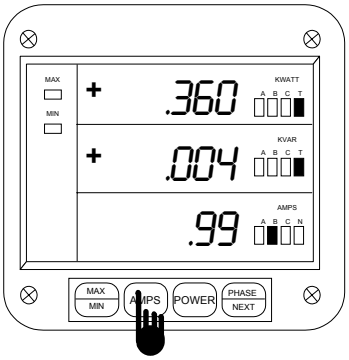


Step 2:
a. Press ***PHASE/NEXT*** to select the desired phase.

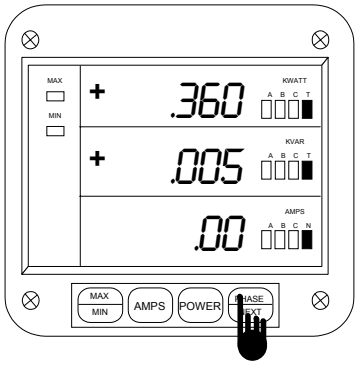
⇨The phases are accessed in a clockwise sequence.

5.2 Accessing Current Phases

The DWVA displays four current measurements (Phases A, B, C and Neutral).



Step 1:
a. Press ***AMPS*** to select the Amps category.

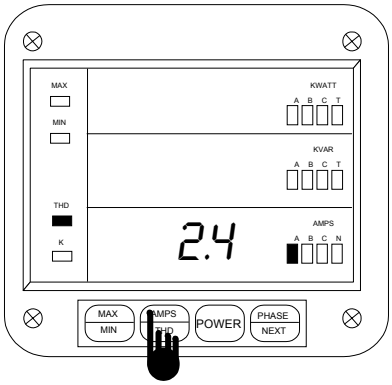


Step 2:
a. Press ***PHASE/NEXT*** to select the desired phase.

5.3 Accessing THD and K-Factor Functions

NOTE: This section is applicable only if the Harmonic Measurement Option -H was ordered with the DWVA.

The DWVA-H measures harmonic Waveforms, THD, and K-Factor for current phases A, B, C. Measurement capability reaches the 31st harmonic order. To access THD and K-Factor follow these steps:



Step 1:
a. Press ***AMPS/THD***:
- Once to access %THD values for a current phase
- Twice to access the K-Factor

⇨The %THD or the K-Factor appears and the appropriate annunciators glow momentarily.

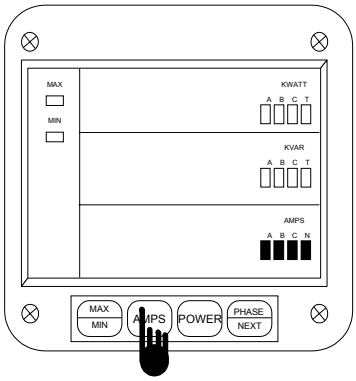
5.4 Accessing Max/Min Values

The max/min values represent the highest and lowest average demand over a user programmable time period known as the **INTEGRATION INTERVAL**. The readings are calculated using a rolling average technique. Each second a new reading is used to calculate the max/min, and the last reading of the interval is dropped off.

To access a max/min value, while displaying a desired phase, press ***MAX/MIN***:
- Once for the max value
- Twice for the min value

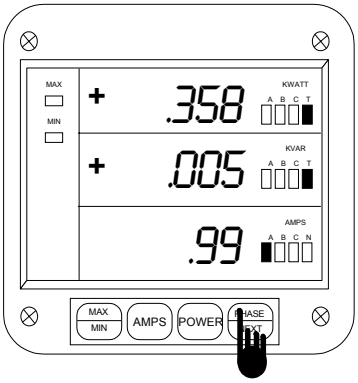
Examples given are for current phases.

To access max/min values for the KWatt and KVAR, press ***MAX/MIN***:
- Once to access positive max
- Twice to access positive min
- Three times to access negative max
- Four times to access negative min

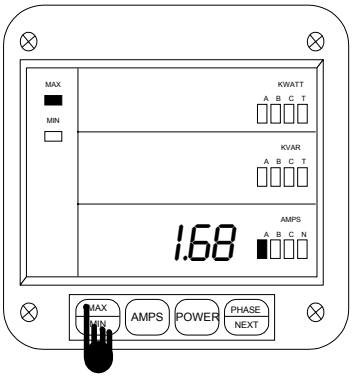


Step 1:
a. Press ***AMPS*** to select the Amps category.

⇨The display blanks and all AMPS annuciators glow for a moment, confirming the selection.



Step 2:
a. Press ***PHASE/NEXT*** to select the desired phase.



Step 3:
a. Press ***MAX/ MIN*** once to view the max reading for AMPS.

⇨The display blanks and then momentarily displays the max value and the annunciator labeled MAX glows.

5.5 Resetting Values

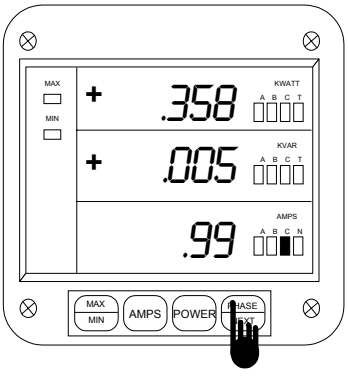
Use the reset function if a new value is desired. It is available in two different modes.

1. **Unprotected Mode** - Allows quick and easy resetting of max/min values.
2. **Protected Mode** - Prevents unauthorized personnel from resetting the max/min.

The following examples are for the max/min of Current Phases.

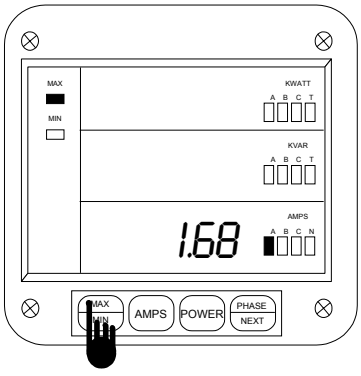
❑ UNPROTECTED RESET

To reset in the unprotected mode, follow these steps:



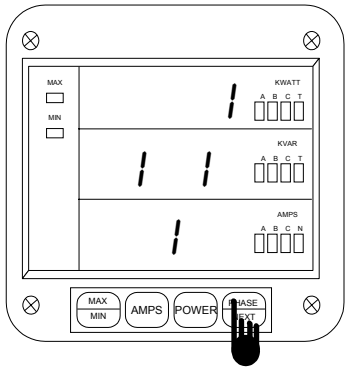
Step 1:
a. Press ***AMPS*** to select the AMPS category.

b. Press ***PHASE/NEXT*** until the desired Phase appears.



Step 2:
a. Press ***MAX/ MIN***:

- Once to access the positive max
- Twice access the positive min
- Three times to access negative max (KW/KVAR)
- Four times to access negative min (KW/KVAR)

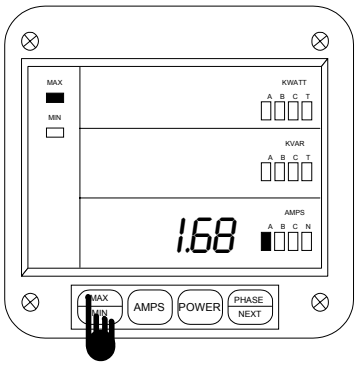


Step 3:
a. Press ***PHASE/NEXT*** to reset the value.

⇨The display blanks and a checkmark appears, confirming reset.

⇨Repeat this procedure for each value you wish to reset.

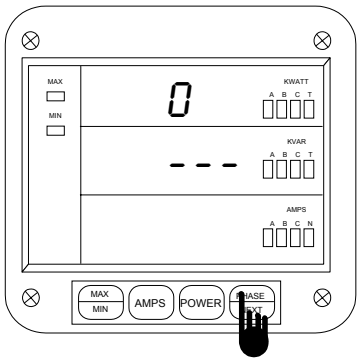
❑ **PROTECTED RESET**



Step 1:

a. Press ***MAX/ MIN***:

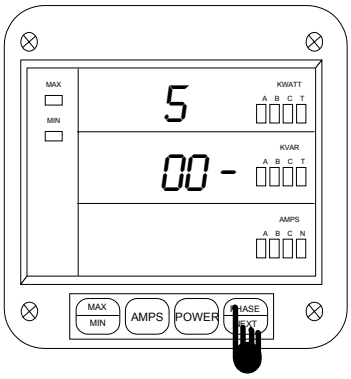
- Once to access the max value
- Twice to access the min value



Step 2:

a. Press ***PHASE/ NEXT*** to commence protected reset.

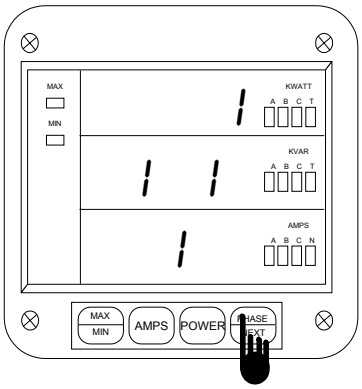
⇨The display blanks, three dashes appear in middle display and digits begin scrolling in upper display.



Step 3:

⇨The password is ***005***.

a. Press ***PHASE/NEXT*** each time the required password number appears.



Step 4:

⇨When the correct password is entered, a checkmark appears which confirms the reset.

ACCESS MODE

The following sections allow the user to access specific operation tasks (see table).

ACCESS	OPERATION
1	Print Operating Data
2	Print Programming Data
3	Enter Programming Mode (see Programming Manual)
4	Firmware Version/LED Test

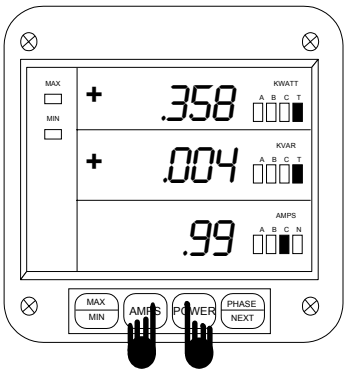
NOTE: Print commands 1 and 2 are only available if enabled in the programming mode and are not recommended when using the multimeter hookup RS485.

5.6 Printing Operating Data

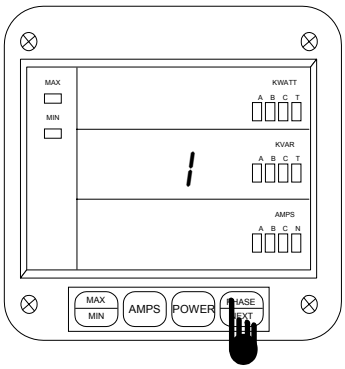
NOTE: This function applies only if a serial printer is connected to the DWVA via an RS-232C Communication Converter.

This function sends data to a serial printer. This allows a hard copy of the instantaneous and max/min data of all functions to compile without manually copying the data.

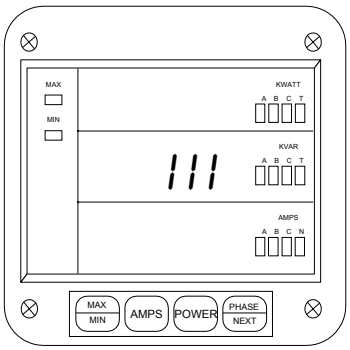
To print the Operating Data follow these steps:



Step 1:
a. Simultaneously press ***POWER*** and ***AMPS*** to begin the printing sequence.



Step 2:
⇨ ***1*** appears in middle display.
a. Press ***PHASE/NEXT*** to select.



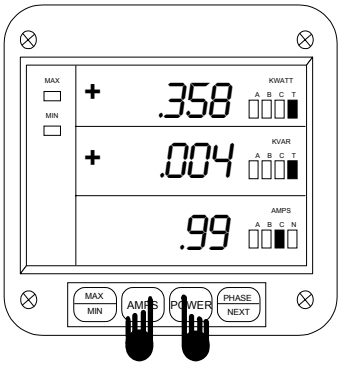
Step 3:
⇨***111*** appears, confirming a successful print command.

5.7 Printing Programming Data

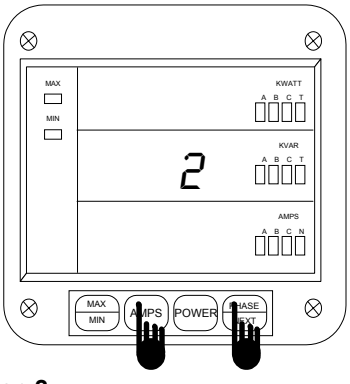
NOTE: This function applies only if a serial printer is connected to the DWVA via an RS-232C Communication Converter.

This function sends the programming data (or the meter setup) to a serial printer for verification and quick reference.

To print the programming data, follow these steps:

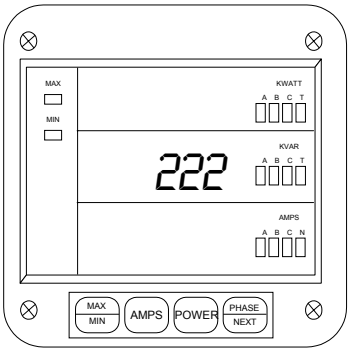


Step 1:
a. Simultaneously press ***POWER*** and ***AMPS*** to begin the printing sequence.



Step 2:
a. Press ***AMPS*** until ***2*** appears.

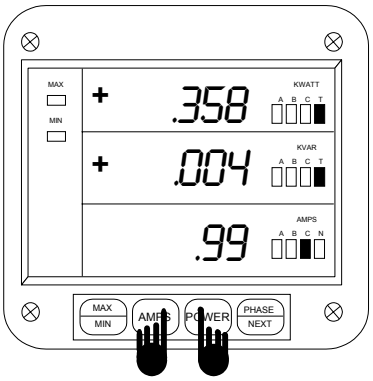
a. Press ***PHASE/NEXT*** to select.



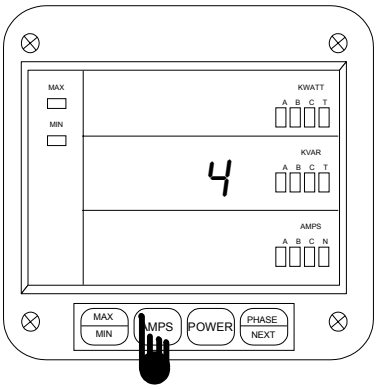
⇨ ***222*** appears, confirming a successful print command.

5.8 Accessing Firmware Version/LED Test

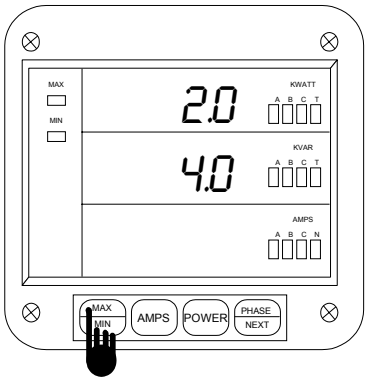
The DWVA accesses the firmware version number of the analog and digital microprocessors. It also performs an LED test to check if the LEDs and annunciators are functioning properly.



Step 1:
a. Simultaneously press ***POWER*** and ***AMPS*** to begin the printing sequence.

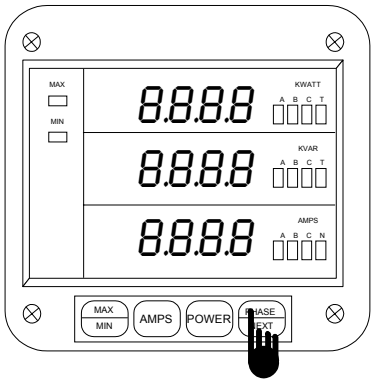


Step 2:
a. Press ***AMPS*** until ***4*** appears.



FIRMWARE VERSION
Step 3:
a. Press ***MAX/MIN*** for the firmware versions.

Firmware versions:
- Upper display - analog processor version
- Middle display - digital processor version



LED TEST
Step 4:
a. Follow Steps 1 and 2, then press ***PHASE/NEXT*** for the LED test.

⇨In the first stage, the LEDs glow.
⇨In the next stage annunciators and ±*1.* LEDs glow.

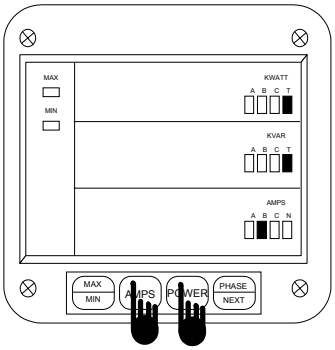
PROGRAMMING YOUR DWVA

CHAPTER 6
Entering The Programming Mode

6.1 Password Entry

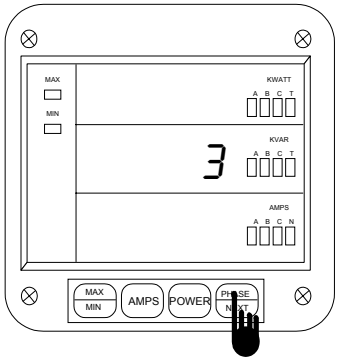
Password entry insures information security and eliminates possible intrusion. For the DWVA the password is preset at the factory and cannot be changed. To enter the Programming Mode, the user needs to correctly enter the password.

Follow the procedure outlined below to enter the password correctly.



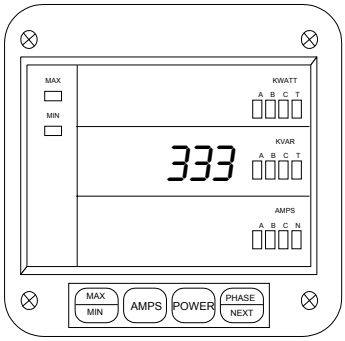
Step 1:
a. Press the ***POWER*** button and the display will blink.

b. Press the ***AMPS*** button until an access number appears in the second row to enter the access mode (see Chapter 5, Access Mode).

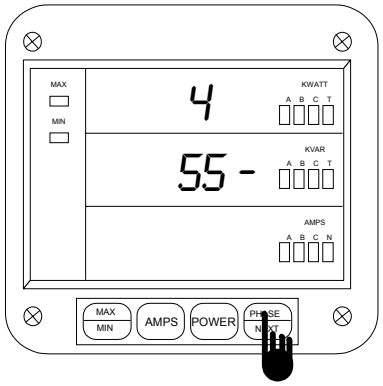


Step 2:
a. Continue to press the ***AMPS*** button and release the ***POWER*** button until a 3 APPEARS.

b. Press ***PHASE/NEXT*** button to select.



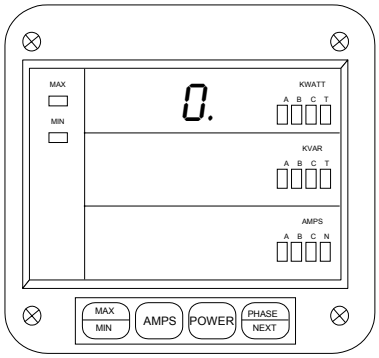
Step 3:
⇒ When ***333*** are displayed, the programming mode has been selected.



⇒ A counter will start scrolling in the first row.

Step 1:
a. When ***5*** appears press the ***PHASE/NEXT*** key once.
⇒ The password is **555.**

b. Press ***PHASE/NEXT*** each time **5** appears.



⇒ Once the password is entered , a ***0.*** will appear in the first row. The meter is now in Programming Mode, GROUP 0.

⇒ You are now in Programming Mode. CONGRATULATIONS!

CHAPTER 7
General Procedure

To simplify things, programming tasks are logically bundled into nine major **GROUPS**. Located within each **GROUP** are specific meter **FUNCTIONS**.

1. Enter the Programming Mode.

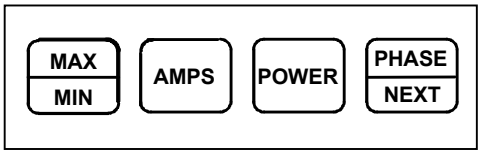
2. Select the appropriate GROUP.

3. Select the desired FUNCTION within the GROUP.

4. When the FUNCTION is selected, we can proceed with DATA ENTRY of the new value of the desired parameter.

5. Once the value is entered, the display returns to the selected FUNCTION, with the new value. From here you may move to another FUNCTION within the GROUP, exit the GROUP and proceed to a different GROUP for programming, or exit the Programming Mode entirely. To alter programming data permanently you must exit the Programming Mode (see Exiting the Programming Mode, Chapter 21)

7.1 Procedure



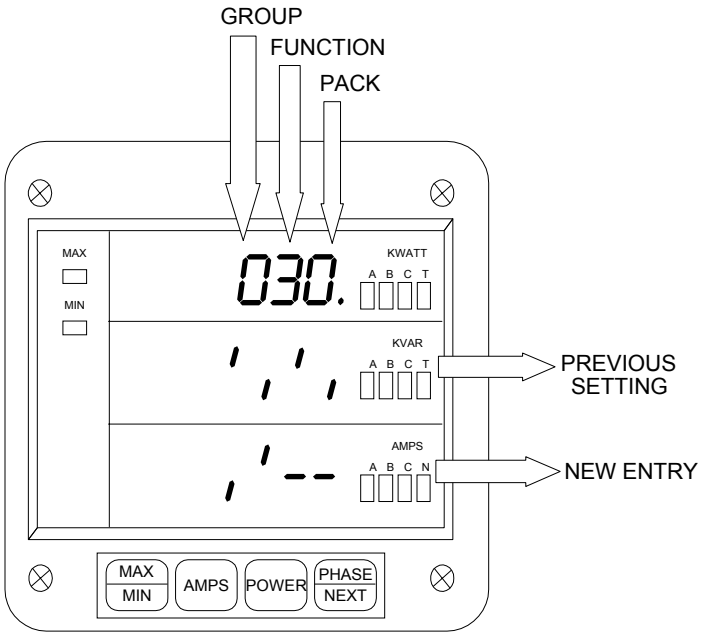
MAX/MIN	To scroll through GROUPS.
POWER	To activate a specific GROUP
MAX/MIN	To scroll through FUNCTIONS.
AMPS	To scroll through packs within FUNCTIONS.
POWER	To activate data entry of FUNCTIONS or Switch PACKS.
AMPS	To scroll through numbers or toggle segments.
POWER	To store selection and proceed to next.
MAX/MIN	To scroll through functions to exit point.
POWER	To exit GROUP.
MAX/MIN	To scroll through GROUPS to exit point.
POWER	To exit Programming Mode.

CHAPTER 8
Important Programming Notes

8.1 Standard Numeric Data Entry

Programmable FUNCTION values are always four digit numeric fields designed to accept any value between 0000 and 9999. When entering the value of a parameter you must enter all four digits, leading zero's included. For instance, if you need to enter the number 25, you must enter 0025.

8.2 Switch Packs



While Programming GROUPS are divided into FUNCTIONS, some FUNCTIONS are further divided into switch packs. These switch packs are a set of separate ON/OFF or toggle switches. These toggle switches have only two positions, either UP segment or DOWN segment. By setting the segment to UP or DOWN, you are turning a particular meter feature ON or OFF, respectively.

CHAPTER 9
PROGRAMMING GROUP 0: Global Meter Setup

Programming Group *0*, The Global Meter Setup, includes Functions ***0*** through ***3,*** which control the configuration and basic operation of the DWVA. See Table 9-1 for a list of Group 0 Functions.

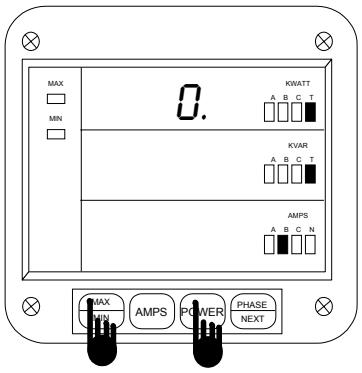
Table 9-1: Group 0 Programming Format

Function Number	Function
0.	Interval
1.	Meter Address for Communication
2.	Baud Rate for Communication
3.	System Configuration
E.	Exit Programming Group 0

9.1 Group 0, Function 0 - The Integration Interval

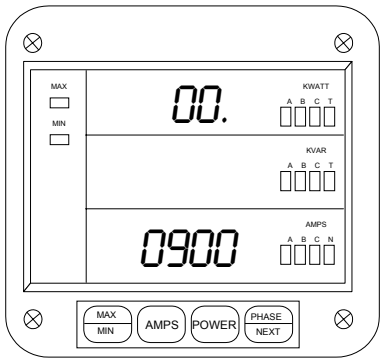
The Integration Interval is the time over which all instantaneous readings are averaged to obtain a maximum and minimum demand. The Integration Interval is entered in seconds. For instance, if you would like to enter 15 minutes, enter 0900 seconds. To change the Integration Interval, follow the steps below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 6, Page 21 for details). If already in Group 0, proceed to Step 3.

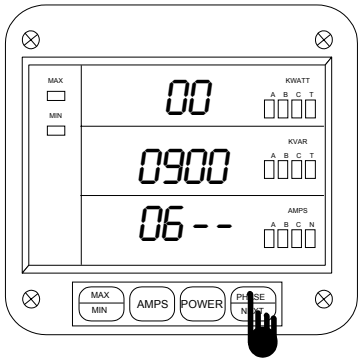


Step 2:
a. Press the ***MAX/MIN*** button until ***0.*** appears in the first row.

b. Press the ***POWER*** button to activate Group *0*.



Step 3:
⇒ The current value is displayed in the bottom level and the group and function number, ***00. in this example***, in the first row.

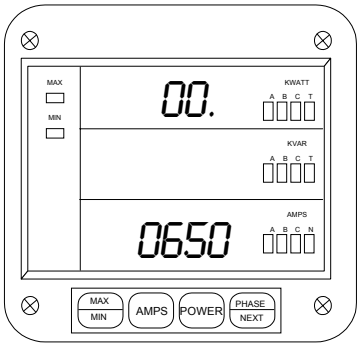


Step 4:
a. Press the ***POWER*** button once to begin the data entry sequence.

⇒ The previous value shifts to the middle row and the bottom row is replaced with four dashes.

b. Press the ***AMPS*** button until the desired number appears.

c. Press the ***POWER*** button to store the digit and proceed to the next.



Step 5:
⇒ Repeat Step 4 until the desired value is entered.

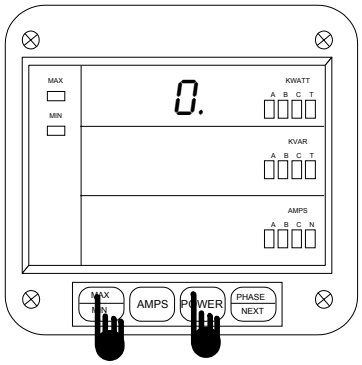
⇒ When complete, the new value is displayed in the lower row and the group and function number is displayed in the upper row.

See Chapter 21 to Exit.

9.2 Group 0, Function 1 - The Meter Address

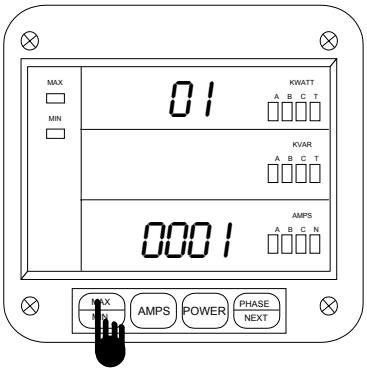
The Meter Address is used to identify the meter when it is communicating with a remote computer system. When there are numerous meters at one site it is essential that each have its own address. To change the Meter Address follow the steps below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 6, Page 21 for details). If already in Group 0, proceed to Step 3.



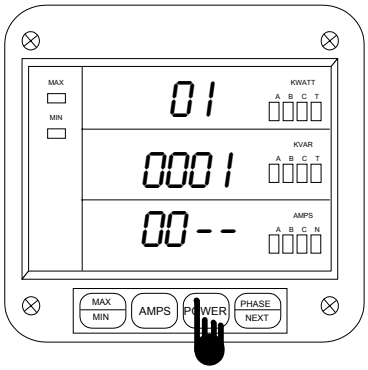
Step 2:
a. Press the ***MAX/MIN*** button until ***0.*** appears.

b. Press the ***POWER*** button to activate Group 0.



Step 3:
a. Press the ***MAX/MIN*** button until ***01.*** appears.

⇒ The current value is displayed in the bottom row.

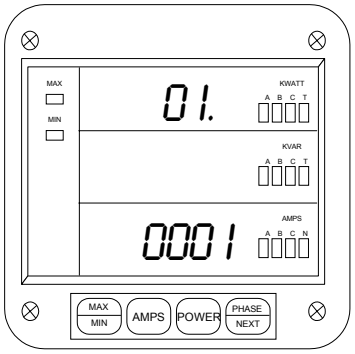


Step 4:
a. Press the ***POWER*** button once to begin the data entry sequence.

⇒ The previous value shifts to the middle display and four dashes appear in the bottom display.

b. Press the ***AMPS*** button until the desired number appears.

c. Press the ***POWER*** button to store the digit and proceed to the next.



Step 5:
⇒ Repeat Step 4 until the desired value is entered.

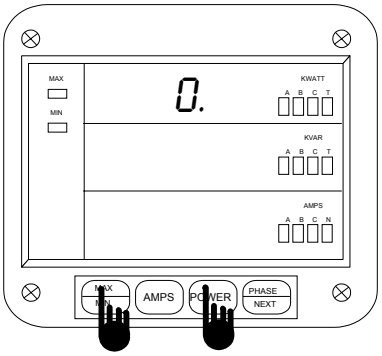
⇒ When complete, the new value is displayed in the lower level and the group and function number are displayed in the upper level.

See Chapter 21 to Exit.

9.3 Group 0, Function 2 - The Communication Baud Rate

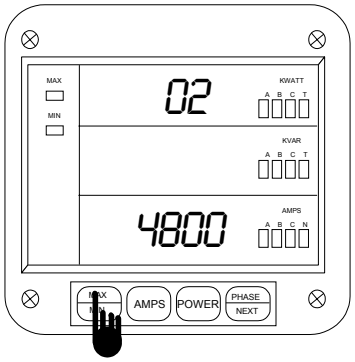
The Baud Rate is the speed at which data is transmitted between the meter and a remote computer or serial printer. The rate that is programmed into the meter must match the rate used by the remote device. Valid Baud Rates are 1200, 2400, 4800 and 9600. To change the Communication Baud Rate, follow the steps below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 6, Page 21 for details). If already in Group 0, proceed to Step 3.



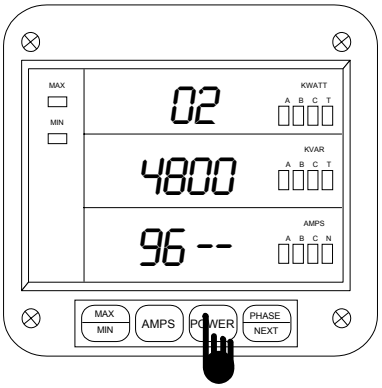
Step 2:
a. Press the ***MAX/MIN*** button until ***0.*** appears.

b. Press the ***POWER*** button to activate Group *0*.



Step 3:
a. Press the ***MAX/MIN*** button until ***02.*** appears.

⇒The current value is displayed in the bottom level.

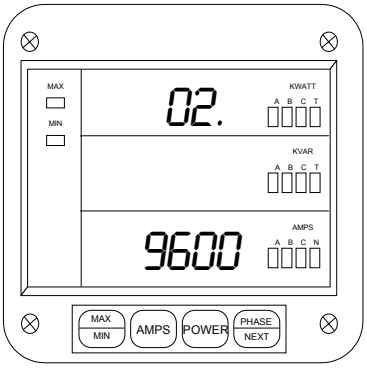


Step 4:
a. Press the ***POWER*** button once to begin the data entry sequence.

⇒ The previous value shifts to the middle row and the bottom row is replaced with four dashes.

b. Press the ***AMPS*** button until the desired number appears.

c. Press the ***POWER*** button to store the digit and proceed to the next.



Step 5:
⇒ Repeat Step 4 until the desired value is entered.

⇒ When complete, the new value is displayed in the bottom row and the group and function number are displayed in the top row.

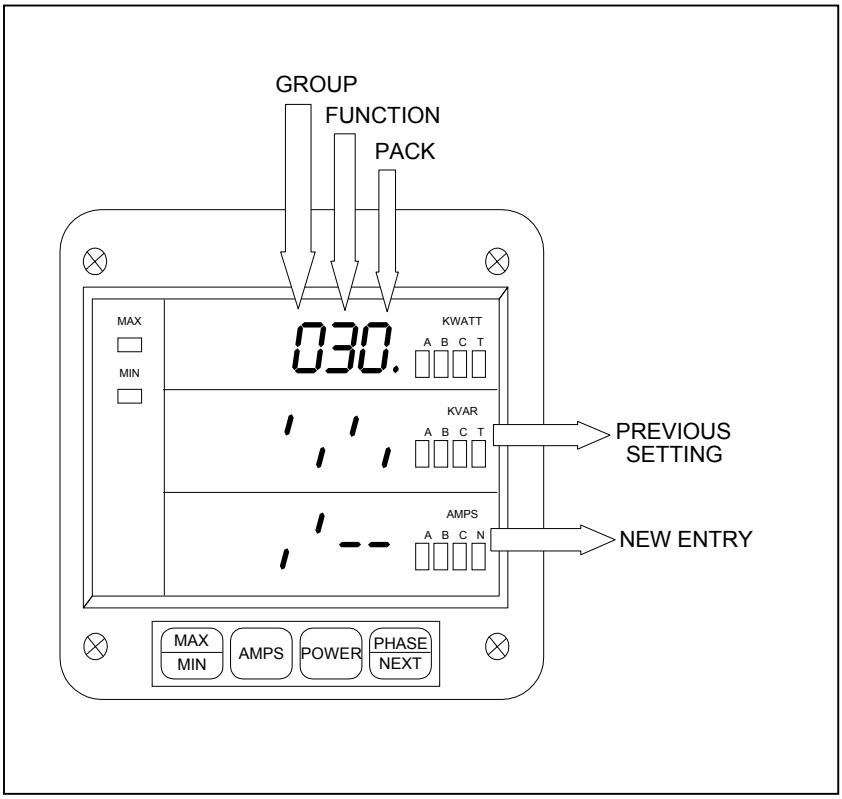
See Chapter 21 to Exit.

9.4 Group 0, Function 3 - System Configuration

The System Configuration is used to set the DWVA basic operation parameters. This Function utilizes Switch PACKS[1].

Function 3 contains four separate switch PACKS, numbered 0 - 3. Each PACK contains four individual UP/DOWN segments. Toggling the segment between UP and DOWN segments, toggles the switch ON or OFF, respectively.

The meter displays one Switch PACK at a time. Use the ***AMPS*** button to scroll from PACK to PACK.



[1] *See SWITCH PACKS, Sections 8.1, 8.2 and Table 9-2, for further details.*

Table 9-2: System Configuration - Switch Features

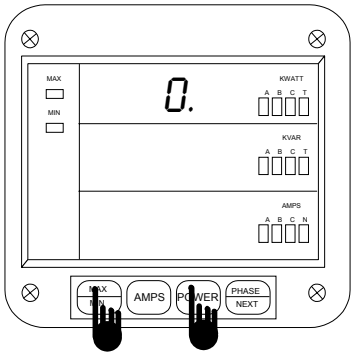
PACK	SWITCH	FEATURE	SEGMENT POSITION
0	A	Reserved	-
	B	Reserved	-
	C	Reserved	-
	D	Reserved	-
1	A	Non-significant Blank Leading Zero	UP=Enable DOWN=Disable
	B	Reset Protection[2]	UP=Enable DOWN=Disable
	C	Reserved	-
	D	Open Delta Installation[3]	UP=Enable DOWN=Disable
2	A	Reserved	-
	B	Reserved	-
	C, D	MODBUS, EI-BUS and DNP 3.0 Protocols	EI-BUS Protocol: C is DOWN, D is DOWN. MODBUS Protocol, ASCII Framing: C is UP, D is UP. MODBUS Protocol, RTU Framing: C is DOWN, D is UP. DNP 3.0 Protocol: C is UP, D is DOWN.
3	A	Reserved	
	B	Reserved	
	C	Communications	UP=Enable DOWN=Disable
	D	DC Output or Print Operating and Programming Data[4]	UP=Enable DOWN=Disable

In order to print operating data (Access Mode 1) and programming data (Access Mode 2) both switches C and D from PACK 3 need to be enabled. Disabling prevents printing through the keypad only and will not affect print commands through communication. The print option should be disabled when using a multi-meter communications hookup, RS-485. Disabling prevents the user from corrupting data at a computer terminal while multiple meters are being polled.

[2] *When enabled, use Protected Reset on Page 18.*

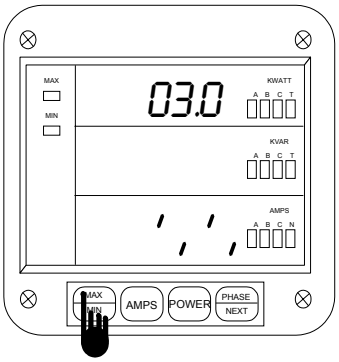
[3] *Enable when Open Delta System is installed (see Page 9).*

[4] *To print, PACK 3 SWITCHES C and D must both be enabled.*



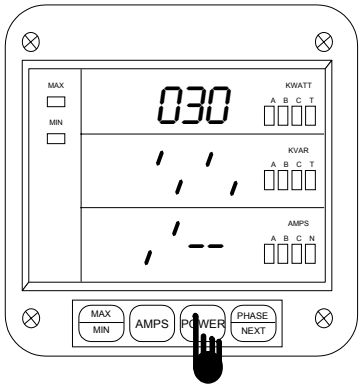
Step 2:
a. Press the ***MAX/MIN*** button until ***0.*** appears.

b. Press the ***POWER*** button to activate Group *0*.



Step 3:
a. Press the ***MAX/MIN*** button until ***03.0*** appears.

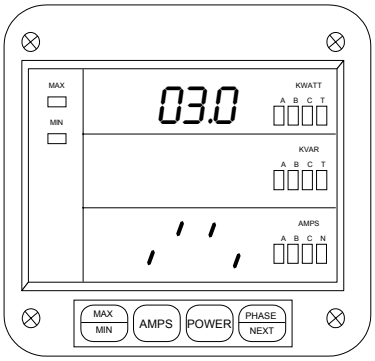
⇒ The current setting for PACK 0 is displayed in the bottom row.



Step 4:
a. Press the ***AMPS*** button until the desired PACK is chosen.

b. Press the ***POWER*** button to activate the data entry sequence.

⇒ The previous setting shifts to the middle row and four dashes appear in the bottom row.



Step 5:
a. Press the ***AMPS*** button to toggle segments for the desired settings.

⇒ Use the ***POWER*** button to store setting and proceed to the next.

⇒ Once all of the desired switches are set, the new setting will be displayed in the bottom row.

See Chapter 21 to Exit.

CHAPTER 10
PROGRAMMING GROUP 1: Full Scale Selection

Programming Group 1 Function provide a selection of Full Scale Settings for Volts and Amps to accommodate different CT'S and PT's that may be in use at the site. Scale selection may be performed in each of the functions. The site technician has a choice of Scale Selection between Volts and Kilovolts, Amps and Kiloamps and Kilowatts and Megawatts.

Table 10-1: Group 1 Programming Format

FUNCTION NUMBER	FUNCTION
0.	Full Scale Selection for Volts
1.	Full Scale Selection for Amps
2.	Full Scale Selection for Watts
E.	Exit Programming Group 1

10.1 Group 1, Function 0 - Full Scale Setting for Voltage Channels and Decimal Point Placement for Voltages

NOTE: Due to the resolution capability of the DWVA, readings over 2000 counts will result in a less stable measurement.

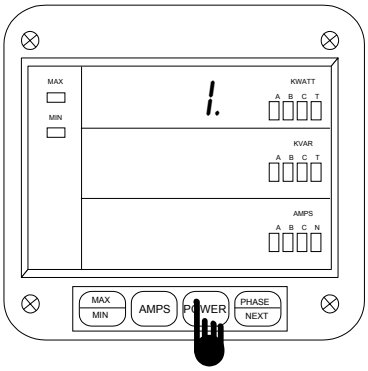
Table 10-2: Full Scale Settings for Volts

SECONDARY PT VALUES	PT RATIO	FULL SCALE
75V(Suffix L) L-N MAX	120:1	9.00 KV
120/208 V	1:1 (Direct)	120.0 V
120/208 V	4:1	0480 V
120/208 V	12:1	1.440 KV
277/480 V (Suffix G)	1:1 (Direct)	0300 V
120/208V	600:1	072.0 KV
120/208	1150:1	138.0 KV

NOTE: Decimal point placement for Volt and Amp channels is selected through Function 0 - Full Scale Volts and Function 1 - Full Scale Amps, respectively. The decimal position must be re-set each time these Functions are used.

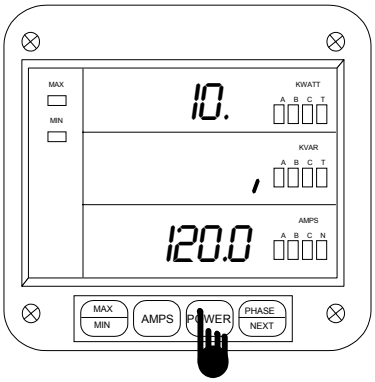
To change the Full Scale Settings follow the steps given below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 6, Page 21 for details). If already in Group 1, proceed to Step 3.



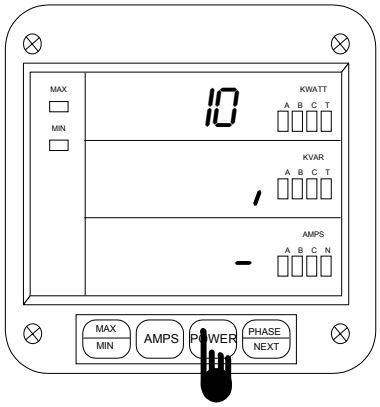
Step 2:
a. Press the ***MAX/MIN*** button until ***1.*** appears.

b. Press the ***POWER*** button to activate Group ***1.***



Step 3:
⇒ ***10.*** appears in the top row.

⇒ The middle row displays the current Scale Factor Setting and the bottom row displays the current Full Scale for Volts.



Entering Scale Factor

Step 4:
a. Press ***POWER*** to activate Scale Factor Entry.

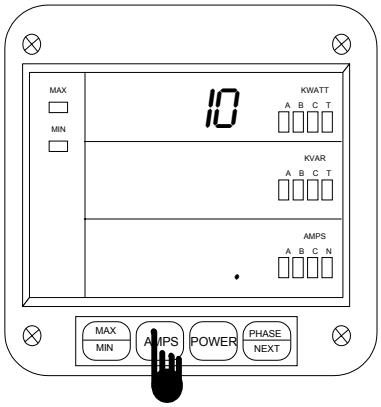
⇒ The previous value is displayed in the middle row and the bottom row is replaced with a single dash.

b. Press the ***AMPS*** button to toggle the segment UP or DOWN, as desired.

⇒ UP indicates Kilovolts.

⇒ DOWN indicates Volts.

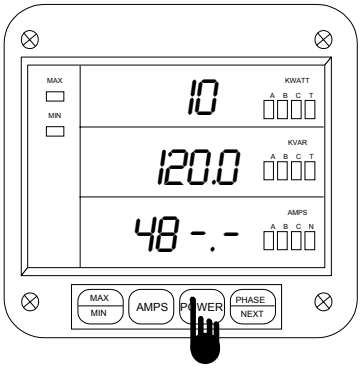
c. Press the ***POWER*** button to store and proceed to decimal point selection.



Decimal Point Selection

Step 5:
⇒ Use the ***AMPS*** button to move the decimal point to desired position.

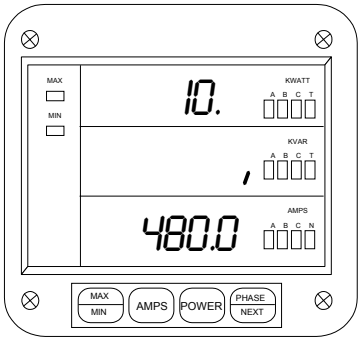
a. Press the ***POWER*** button to store and to proceed to entry of the Full Scale.



Step 6:
⇒ The previous value shifts to the middle display and the bottom display is replaced with four dashes

a. Press the ***AMPS*** button until the desired number appears.

b. Press the ***POWER*** button to store and proceed to the next.



Step 7:
⇒ Repeat Step 6 until the desired value is entered.

⇒ When complete, the new value is displayed in the lower level.

- The unit segment is displayed in the middle level.
- The group and function number are displayed in the top row.

To exit GROUP *1*, refer to Chapter 21, Exiting the Programming Mode.

10.2 Group 1, Function 1 – Full Scale Selection for Current Channels (Amperage) and Decimal Point Placement for Current

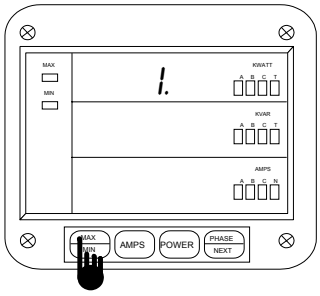
Table 10-3: Full Scale Settings for Amps

CT TYPE	FULL SCALE
Direct Input	0.500 A
600/5	0600 A
1000/5	1000 A
2000/5	2000 A
3000/5	03.00 KA
5000/5	05.00 KA

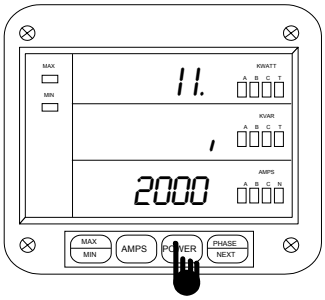
Also note that the meter reads with digital accuracy to a 2000 count range. So, all CT and PT Full Scale settings in the meter should reflect that limitation. The table above shows the proper settings.

To change the Full Scale Settings:

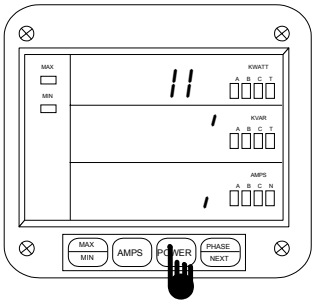
NOTE: Press ***MAX/MIN*** at any time to cancel before storing the last digit or switch.



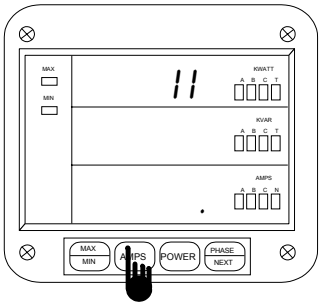
Step 1:
a. Enter Group Level of Programming Mode (see Ch 8).
b. Press ***MAX/MIN*** until 1. appears in upper display.



Step 2:
a. Press ***POWER*** to activate the Group.
b. Press ***MAX/MIN*** until 11. appears in the upper display.
⇒ Middle display indicates Scale Factor Setting.
⇒ Lower display indicates Full Scale.

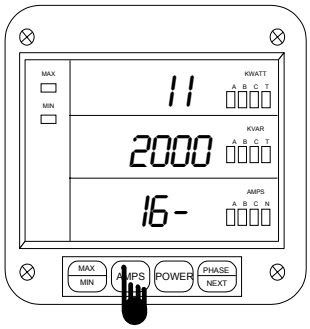


Step 3: (Entering the Scale Factor)
a. Press ***POWER*** to begin Data Entry Sequence.
⇒ Lower display is replaced with a single dash.
b. Press ***AMPS*** to move the segment UP or DOWN to set Scale Factor.
⇒ UP signifies – Kiloamps.
⇒ DOWN signifies – Amps.
c. Press ***POWER*** to store.



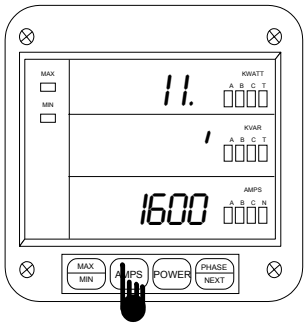
Step 4: (Decimal Point Selection)
a. Press ***AMPS*** to move the decimal point.

b. Press ***POWER*** to store.



Step 5:
⇒ Middle display shows Full Scale for current.
⇒ Four dashes appear in lower display.
a. Press ***AMPS*** to enter four-digit Full Scale.

b. Press ***POWER*** to store each digit.



⇒ Repeat this procedure until all four digits are entered.
⇒ Lower display indicates new Full Scale Setting.
⇒ Middle display indicates Scale Factor. Group and Function Number appear (including decimal point) in upper display.

10.3 Group 1, Function 2 - Scale Selection and Decimal Point Placement for Kilowatts/Megawatts

Programming Group 1 also provides decimal point positioning for maximum resolution. The following three examples are provided to aid in selecting the best decimal position for Function 2.

EXAMPLE 1:
Full Scale Voltage (FSV) = 120 V
Full Scale Amperage (FSA) = 5.00 A

Full Scale Wattage (FSW) is the product of FSV and FSA. For the FSW for three phases, multiply the FSW by 3.

FSW (one phase) = 120 V • 5.00 A
FSW (one phase) = 600 W
FSW (three phase)= 600 W • 3 = 1,800 W

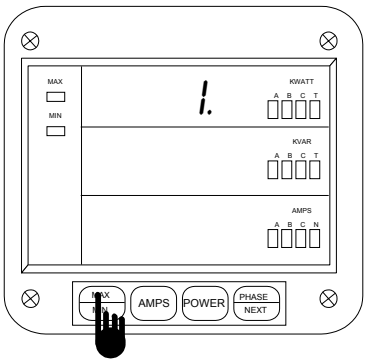
Here the FSW is too small a value for a Megawatt meter. FSW in the Kilowatt meter equals 1.800 KW. In Function *2*, place the decimal point after the first digit.

EXAMPLE 2: 480/120, 1000/5 CT
FSV = 480 V
FSA = 1000 A
FSW (one phase) = 480 V • 1000 A
FSW (one phase) = 480,000 W
FSW (three phase)= 480,000 W • 3 = 1,440,000 W

FSW for a Kilowatt meter equals 1440. KW. FSW for a Megawatt meter equals 1.440 MW. In Function 2 place the decimal point after the last digit for a Kilowatt meter and after the first digit for a Megawatt meter.

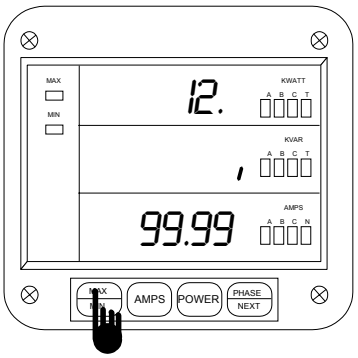
EXAMPLE 3:
FSV = 1.440 KV
FSA = 1000 A
FSW (one element) = 1440 V • 1000 A
FSW (one element) = 1,440,000 W
FSW (three element) = 1,440, 000 W • 3 = 4,320,000 W

FSW for a Kilowatt meter equals 4320 KW. Here the FSW is too large a value for a Kilowatt meter (the range is 0 - 2000). FSW for a Megawatt meter equals 04.32 MW. In Function *2*, place the decimal point after the second digit. If not at Group Level of Programming Mode, use password entry sequence to begin (see Chapter 6, Page 21 for details). If already in Group 1, proceed to Step 3.

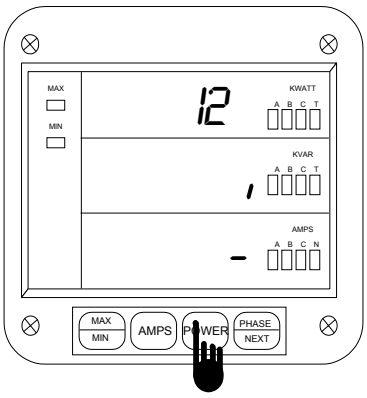


Step 1:
a. Press the ***MAX/MIN*** button until ***1.*** appears.

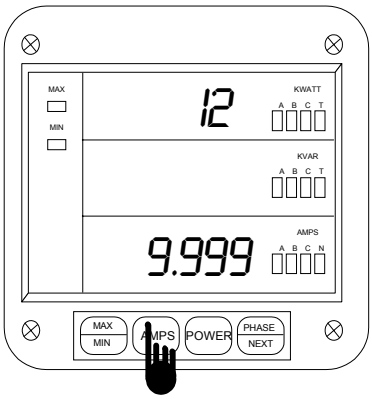
b. Press the ***POWER*** button to activate Group ***1.***



Step 2:
a. Press ***MAX/MIN*** until 12. appears.
⇨ Middle display indicates current Scale Factor Setting.
⇨ Lower display indicates 9999 and Decimal Point Placement Settings.



Step 3: (Entering Scale Factor)
a. Press ***POWER*** to begin Data Entry Sequence.
⇨ Lower display is replaced with a single dash.
b. Press ***AMPS*** to move the segment.
⇨ UP signifies – megawatts.
⇨ DOWN signifies – kilowatts.
c. Press ***POWER*** to store.



Step 4: (Decimal Point Selection)
⇨ Display blanks then lower display indicates 9999 and Decimal Point Placement Settings.
a. Press ***AMPS*** to move decimal.
b. Press ***POWER*** to store.

See Chapter 21 to Exit.

CHAPTER 11
PROGRAMMING GROUP 2: Calibration

WARNING - READ THIS SECTION CAREFULLY BEFORE PROCEEDING

- *The calibration procedure requires highly accurate and stable input signals. Incorrect readings result from improper calibration procedures. If unsure, return the unit to the factory for calibration.*
- *BEFORE calibrating any channel, make a note of its Full Scale Setting (See Chapter 10). Set the Full Scale in accordance with **Table 11-2** for calibration. Restore original Full Scale Setting when calibration is completed.*
- *The first function in GROUP 2 (STD.CORR) is **NOT** to be changed by the user. Please make a note of the value here (□□□□) before using any other function in this group. If the STD.CORR value is inadvertently lost or changed, contact the factory for assistance.*

All sensitive electronic measuring devices may *drift* slightly over time and require periodic calibration. We recommend returning the meter to the factory on a yearly basis for proper calibration.

11.1 Calibration Requirements

FUNCTIONS *0-8* (High and Low End Calibration) can be calibrated by qualified site technicians, if a stable calibration source can be applied. Otherwise, the meter should be checked for linearity and accuracy annually. Calibrate if necessary.

Calibration on the DWVA requires precise inputs of 120 Volts, 5 Amps and 2.5 Amps. The DWVA-G model requires precise inputs of 300 Volts, 5 Amps and 2.5 Amps. If this equipment is unavailable, contact the factory for assistance.

Table 11-1: Group 2 Programming Format

FUNCTION NUMBER	FUNCTION
P.	Standard Correction - Factory Procedure only.
0.	High End Calibration - Volts AN
1.	High End Calibration - Volts BN
2.	High End Calibration - Volts CN
3.	High End Calibration - Amps A
4.	High End Calibration - Amps B
5.	High End Calibration - Amps C
6.	Low End Calibration - Amps A
7.	Low End Calibration - Amps B
8.	Low End Calibration - Amps C
E.	Exit Programming GROUP 2

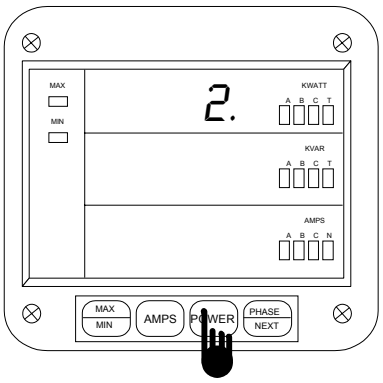
The Full Scale and Calibration values should be equal during the calibration procedure. Refer to Table 11-2 for examples of Full Scale and Calibration settings.

Table 11-2: Calibration Source, Full Scale and Value Settings for Calibration

Calibration Type/Ranges	Calibration Source	Full Scale Setting/Scale Factor	Calibration Value
Volts 75 V	75 V	075.0 V	075.0
Volts 120.13/`1 PT	75 V	9.01 KV	09.01
Volts 120/208 V	120 V	0120 V	0120
Volts 4/1 PT	120 V	0480 V	0480
Volts 60/1 PT	120 V	07.20 KV	07.20
Volts 277/480 V	300 V	0300 V	0300
Amps Hi End 1000/5 CT	5 A	1000 A	1000
Amps Hi End 5000/5 CT	5 A	5.00 KA	05.00
Amps Lo End 1000/5 CT	2.5 A		0500
Amps Lo End 5000/5 CT	2.5 A		02.50

11.2 Group 2, Functions 0-8 - High End Calibration of Voltage Channels, High and Low End Calibration of Amperage Channels

⇨To change the **CALIBRATION**, follow these steps:



Step 1:
a. Enter Group Level of Programming Mode.

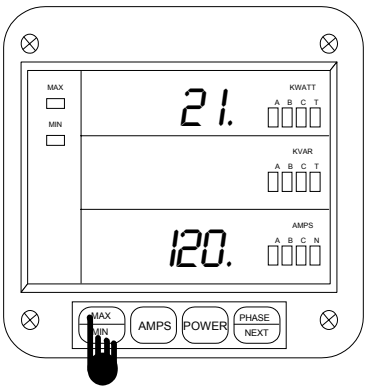
b. Press ***MAX/MIN*** until ***2.*** appears in upper display.

c. Press ***POWER*** to activate the Group.

⇨A one-digit password is required to continue.

d. Press ***AMPS*** until ***5*** appears.

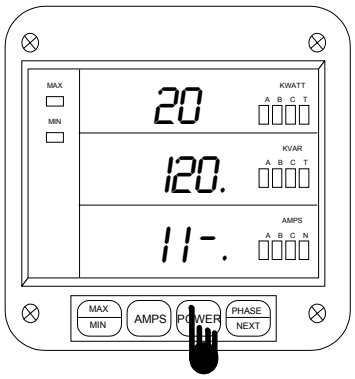
e. Press ***POWER*** to select.



Step 2:
⇨Refer to **Table 11-1** for Function Number that corresponds to channel requiring calibration.

a. To calibrate Volts BN, press ***MAX/MIN*** until ***21.*** appears in upper display.

(2P. is pre-calibrated. This is a factory set value and should not be altered).



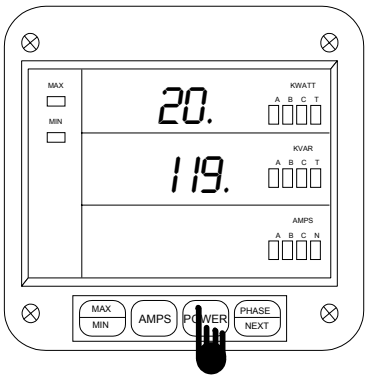
Step 3:
⇨At this time the calibration source should be applied to the appropriate channel.

a. Press ***POWER*** to activate calibration.

⇨The current value move to middle display and the lower display is replaced with four dashes.

b. Press ***AMPS*** to scroll through the numbers.

c. Press ***POWER*** to store.



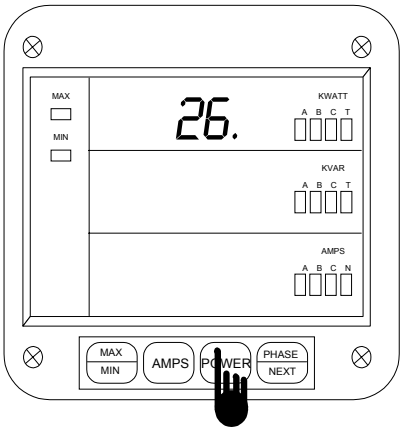
Step 4:
⇨When the entry is complete, the new value moves to the middle display.

⇨The lower display indicates the calibration reading after 10-15 seconds.

a. Press ***MAX/MIN*** to end the calibration sequence.

REPEAT THE SAME PROCEDURE FOR FUNCTION 0 - 5.

FOR FUNCTION 6, FOLLOW THESE STEPS:



Step 1:
⇨Set the source to half of the current Hi End Scale.

a. Press ***MAX/MIN*** until ***26.*** appears in upper display.

b. Press ***POWER*** to activate.

⇨The middle and lower displays blank.

⇨After 10 seconds the calibrated number appears momentarily.

Step 2:
⇨ When the entry is complete the new values moves to the middle display.

⇨ The lower display indicates the calibrated reading after 10-15 seconds.

a. Press ***MAX/MIN*** to end the Calibration Procedure.

You cannot cancel at this time.

CHAPTER 12
PROGRAMMING GROUP 3: Correction Ratios

The DWVA is constructed with two separate modules joined by a connector and secured with two screws. The front module (*meter module*) contains the microprocessors, displays and related circuitry. The rear module (*input module*) supports all incoming signal connections. The sections can be easily separated, allowing the meter module to be moved, or serviced, off-site without interrupting service loops or removing meter connections.

Though a lot simpler in design, the input module does contain some step down circuitry. Due to normal CT tolerance and resistance limitations, small channel offsets unique to each input module can be seen. *They are measured at the factory and printed on the face of the input (rear) module. We refer to them as* ***CORRECTION RATIOS****.*

The Programming Mode makes it possible to key in the CORRECTION RATIO values of any input module to which the meter is attached. This allows a site technician to move a meter to a different input module, re-program the correction ratios and resume accurate power metering.

Warning: An Incorrect entry will result in false readings.

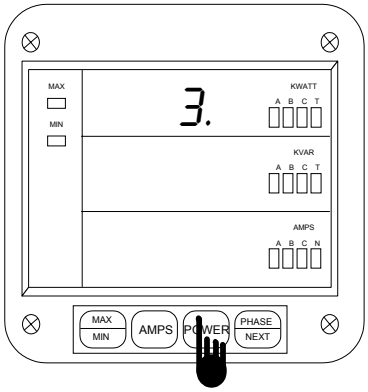
TABLE 12-1: GROUP 3 PROGRAMMING FORMAT

Function Number	Function
0.	Hi End Correction Ratio, Volts AN
1.	Hi End Correction Ratio, Volts BN
2.	Hi End Correction Ratio, Volts CN
3.	Hi End Correction Ratio, Amps A
4.	Hi End Correction Ratio, Amps B
5.	Hi End Correction Ratio, Amps C
6.	Low End Correction Ratio, Amps A
7.	Low End Correction Ratio, Amps B
8.	Low End Correction Ratio, Amps C
e.	Exit Programming Group 3

12.1 Group 3, Functions 0-2 - Hi End Correction Ratios

To change the Correction Ratio, follow the steps below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 1, Page 21 for details). If already in Group 3, proceed to Step 3.



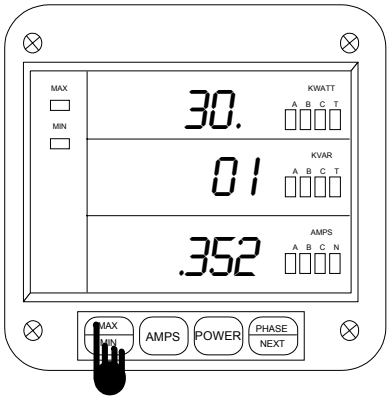
Step 2:
a. Press the ***MAX/MIN*** button until ***3.*** is displayed.

b. Press the ***POWER*** button to activate.

⇒ A one-digit password is required to continue.

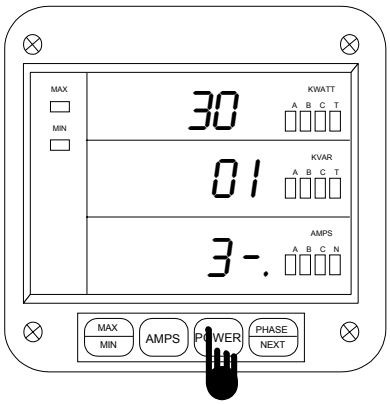
c. Press the ***AMPS*** button until ***5*** appears

d. Press ***POWER*** to select.



Step 3:
a. Press ***MAX/MIN*** button to select the desired function (*0-8*).

⇒The middle row displays the integer portion and the bottom row displays the fractional portion of the ratio.

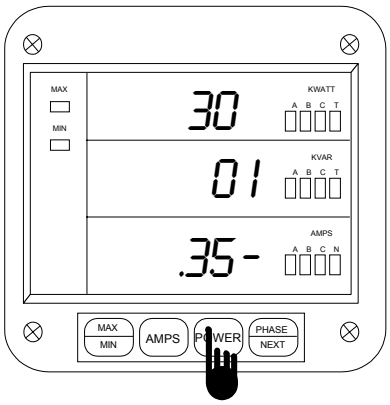


Step 4:
a. Press ***POWER*** to begin entering the integer portion of the new ratio.

⇒ Two dashes appear on the bottom level. *(To skip to changing the fractional portion press MAX/MIN once and proceed to Step 5.)*

b. Use the ***AMPS*** button to scroll through numbers

c. Press ***POWER*** to select the number[1] and proceed to the next.



Step 5:
⇒ Entering the fractional portion of the ratio repeat Step 4.

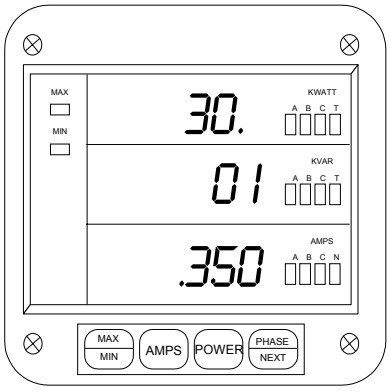
a. Use the ***AMPS*** button to scroll through numbers

b. Press ***POWER*** to select the number[2] and proceed to the next.

[1] *To cancel at any time press L-N/L-L twice.*
[2] *To cancel at any time press L-N/L-L once.*

Step 6:
⇒ When the new ratio is complete the meter replaces the old correction ratio with the new.

⇒ The middle level displays the integer portion and the bottom level displays the fractional portion of the ratio.



To exit Group *3*, refer to *Chapter 21, Exiting the Programming Mode.*

CHAPTER 13
DWVV: AN OVERVIEW

The DWVV meter is detailed in Chapters 13 – 20. The DWVA meter is detailed in Chapters 5 – 12.
The DWVV reads up to 14 electrical parameters. Values for each parameter are accessed through the keypad.

VOLTS	POWER
A-N, A-B	± KWATT A, B, C
B-N, B-C	± KVAR A, B, C
C-N, C-A	± TOTAL KWATT ±TOTAL KVAR

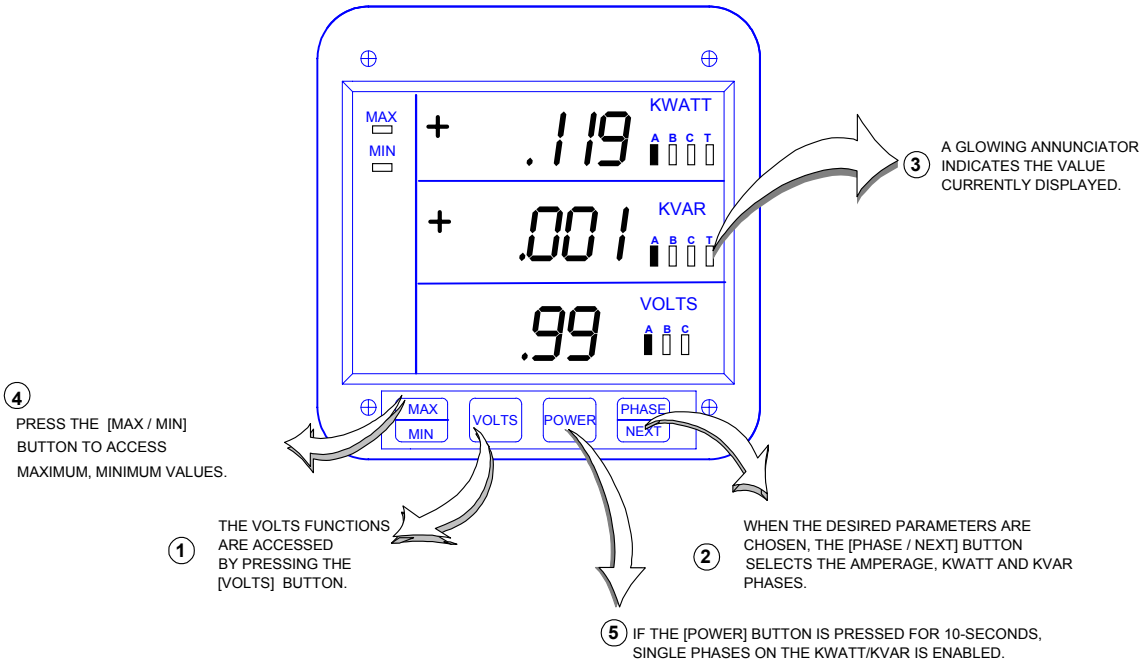
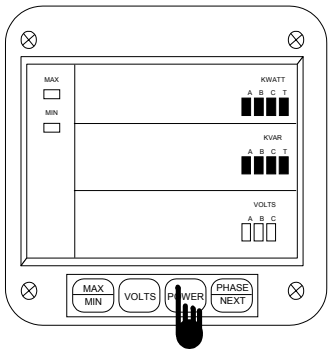
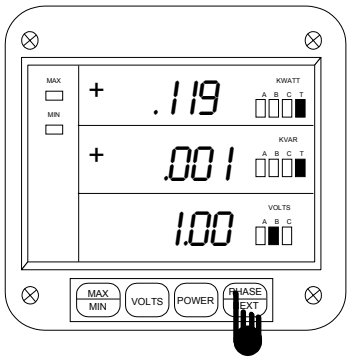


Diagram 13.1 The DWVV front panel with display and keypad.

13.1 Accessing KW/KVAR Single Phases

Start with a blank display.





Step 1:
a. Press ***POWER*** for 10 seconds to view single phases for KW and KVAR.

⇨The display blanks and all annunciators in the KW and KVAR section glow, confirming the selection.

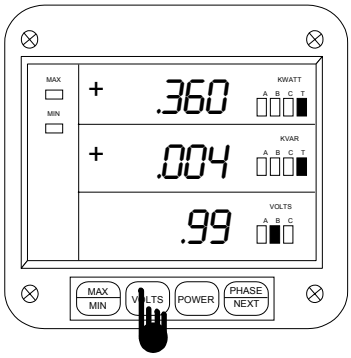
Step 2:
a. Press ***PHASE/NEXT*** to select the desired phase.

⇨The phases are accessed in a clockwise sequence.

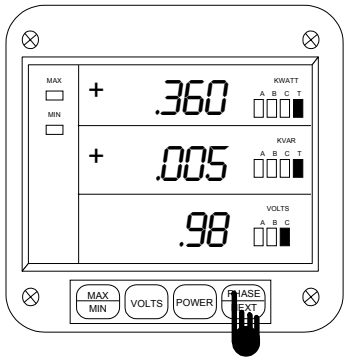
13.2 Accessing Voltage Phases

The DWVV displays six voltage measurements:

Phase to Neutral A-N, B-N, C-N
Phase to Phase A-B, B-C, C-A



Step 1:
a. Press ***VOLTS*** to select the Volts category.



Step 2:
a. Press ***PHASE/NEXT*** to select the desired phase.

13.3 Accessing Max/Min Values

The max/min values represent the highest and lowest average demand over a user programmable time period known as the **INTEGRATION INTERVAL**. The readings are calculated using a rolling average technique. Each second a new reading is used to calculate the max/min, and the last reading of the interval is dropped off.

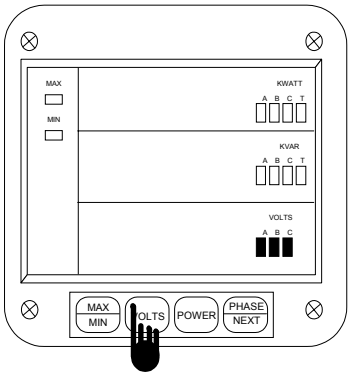
To access a max/min value, while displaying a desired phase, press ***MAX/MIN***:

- Once for the max value
- Twice for the min value

Examples given are for voltage phases.

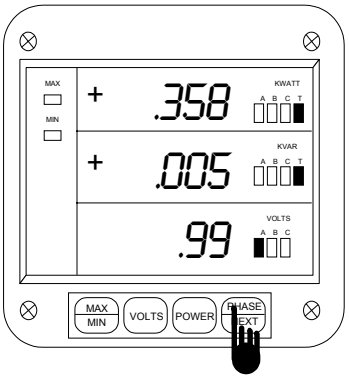
To access max/min values for the KWatt and KVAR, press ***MAX/MIN***:

- Once to access positive max
- Twice to access positive min
- Three times to access negative max
- Four times to access negative min

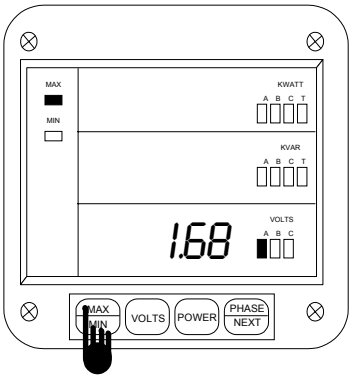


Step 1:
a. Press ***VOLTS*** to select the Volts category.

⇨The display blanks and all VOLTS annuciators glow for a moment, confirming the selection.



Step 2:
a. Press ***PHASE/NEXT*** to select the desired phase.



Step 3:
a. Press ***MAX/ MIN*** once to view the max reading for VOLTS.

⇨The display blanks and then momentarily displays the max value and the annunciator labeled MAX glows.

13.4 RESETTING VALUES

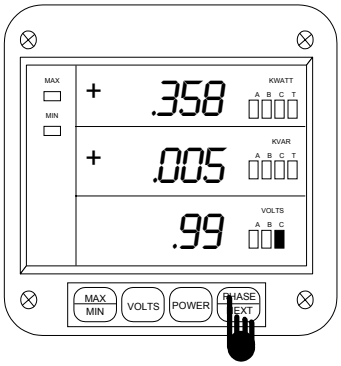
Use the reset function if a new value is desired. It is available in two different modes.

1. **Unprotected Mode** - Allows quick and easy resetting of max/min values.
2. **Protected Mode** - Prevents unauthorized personnel from resetting the max/min.

The following examples are for the max/min of Current Phases.

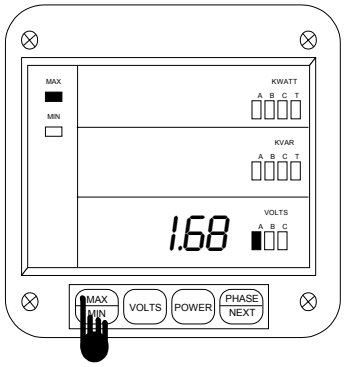
❑ UNPROTECTED RESET

To reset in the unprotected mode, follow these steps:



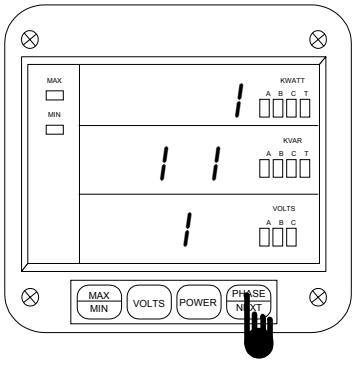
Step 1:
a. Press ***VOLTS*** to select the Volts category.

b. Press ***PHASE/NEXT*** until the desired Phase appears.



Step 2:
a. Press ***MAX/ MIN***:

- Once to access the positive max
- Twice access the positive min
- Three times to access negative max (KW/KVAR)
- Four times to access negative min (KW/KVAR)

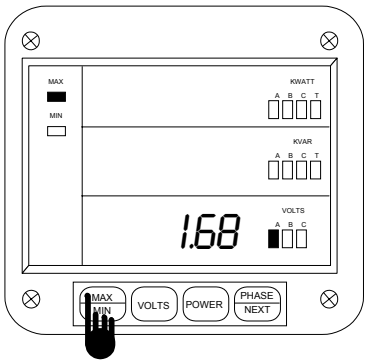


Step 3:
a. Press ***PHASE/NEXT*** to reset the value.

⇨The display blanks and a checkmark appears, confirming reset.

⇨Repeat this procedure for each value you wish to reset.

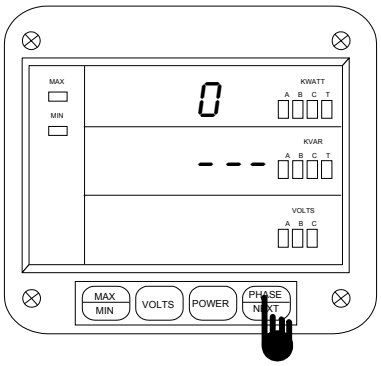
❑ **PROTECTED RESET**



Step 1:

a. Press ***MAX/ MIN***:

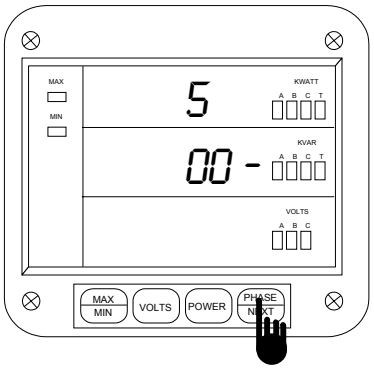
- Once to access the max value
- Twice to access the min value



Step 2:

a. Press ***PHASE/ NEXT*** to commence protected reset.

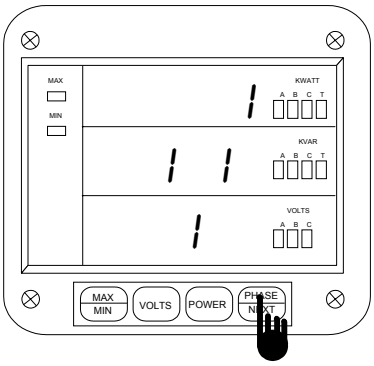
⇨The display blanks, three dashes appear in middle display and digits begin scrolling in upper display.



Step 3:

⇨The password is ***005***.

a. Press ***PHASE/NEXT*** each time the required password number appears.



Step 4:

⇨When the correct password is entered a checkmark appears, confirming reset.

ACCESS MODE

The following sections allow the user to access specific operation tasks (see table).

ACCESS	OPERATION
1	Print Operating Data
2	Print Programming Data
3	Enter Programming Mode (see Programming Manual)
4	Firmware Version/LED Test

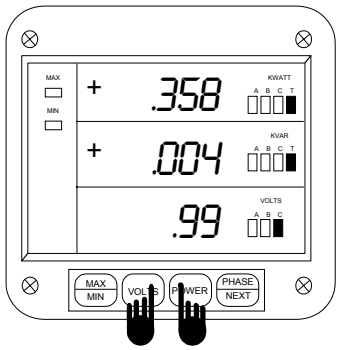
NOTE: Print commands 1 and 2 are only available if enabled in the programming mode and are not recommended when using the multimeter hookup RS485.

13.5 Printing Operating Data

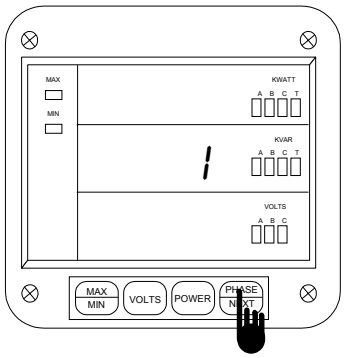
NOTE: This function applies only if a serial printer is connected to the DWVV via an RS-232C Communication Converter.

This function sends data to a serial printer. This allows a hard copy of the instantaneous and max/min data of all functions to compile without manually copying the data.

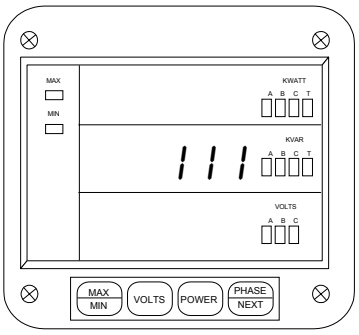
To print the Operating Data follow these steps:



Step 1:
a. Simultaneously press ***POWER*** and ***VOLTS*** to begin the printing sequence.



Step 2:
⇨ ***1*** appears in middle display.
a. Press ***PHASE/NEXT*** to select.



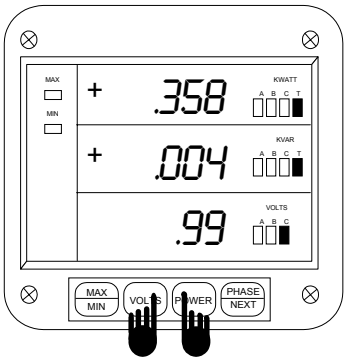
Step 3:
⇨***111*** appears, confirming a successful print command.

13.6 Printing Programming Data

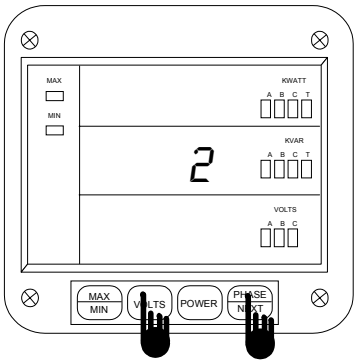
NOTE: This function applies only if a serial printer is connected to the DWVV via an RS-232C Communication Converter.

This function sends the programming data (or the meter setup) to a serial printer for verification and quick reference.

To print the programming data, follow these steps:

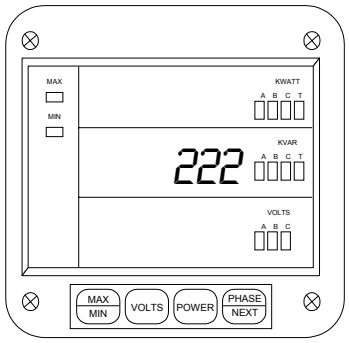


Step 1:
a. Simultaneously press ***POWER*** and ***VOLTS*** to begin the printing sequence.



Step 2:
a. Press ***VOLTS*** until ***2*** appears.

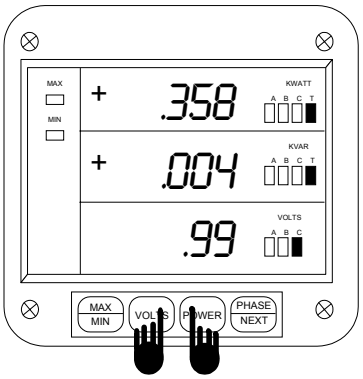
a. Press ***PHASE/NEXT*** to select.



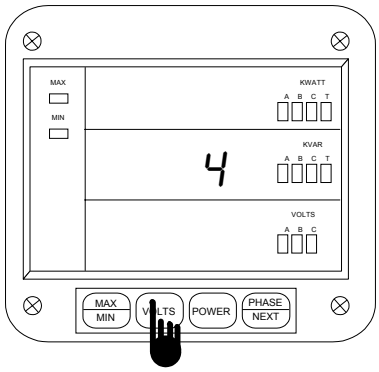
⇨ ***222*** appears, confirming a successful print command.

13.7 Accessing Firmware Version/LED Test

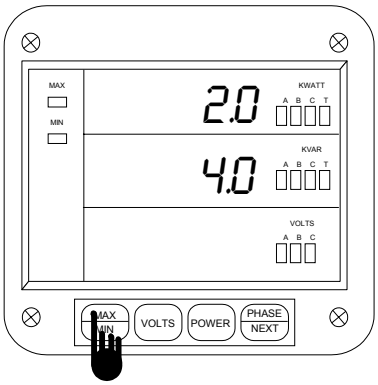
The DWVV accesses the firmware version number of the analog and digital microprocessors. It also performs an LED test to check if the LEDs and annunciators are functioning properly.



Step 1:
a. Simultaneously press ***POWER*** and ***VOLTS*** to begin the printing sequence.

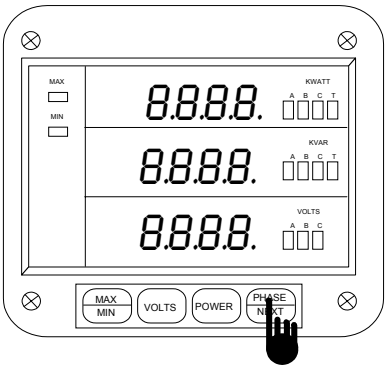


Step 2:
a. Press ***VOLTS*** until ***4*** appears.



FIRMWARE VERSION
Step 3:
a. Press ***MAX/MIN*** for the firmware versions.

Firmware versions:
- Upper display - analog processor version
- Middle display - digital processor version



LED TEST
Step 4:
a. Follow Steps 1 and 2, then press ***PHASE/NEXT*** for the LED test.

⇨In the first stage, the LEDs glow.
⇨In the next stage annunciators and ±*1.* LED glow.

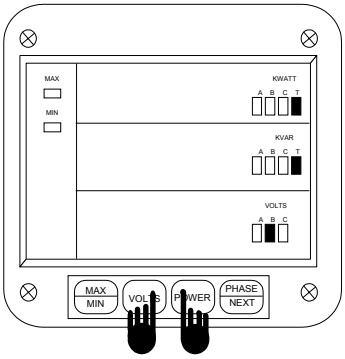
PROGRAMMING YOUR DWVV

CHAPTER 14
Entering The Programming Mode

14.1 Password Entry

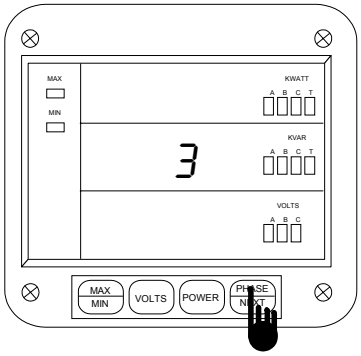
Password entry insures information security and eliminates possible intrusion. For the DWVV the password is preset at the factory and cannot be changed. To enter the Programming Mode, the user must correctly enter the password.

Follow the procedure outlined below to enter the password correctly.



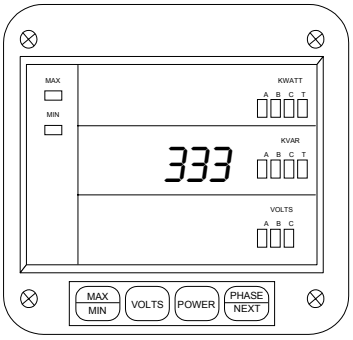
Step 1:
a. Press the ***VOLTS*** and ***POWER*** buttons at the same time; the display blinks.

b. Press the ***VOLTS*** button until an access number appears in the second row (see Chapter 13, Access Mode).

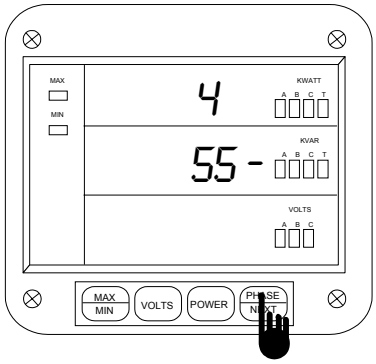


Step 2:
a. Continue to press the ***VOLTS*** button and release the ***POWER*** button until a 3 APPEARS.

b. Press ***PHASE/NEXT*** button to select.

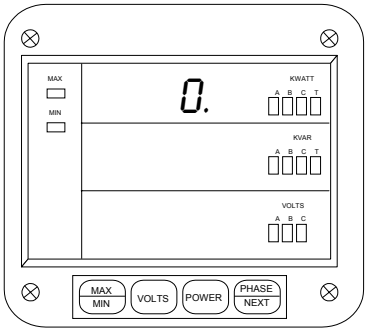


Step 3:
⇒ When ***333*** are displayed, the programming mode has been selected.



⇒ A counter will start scrolling in the first row.
Step 1:
a. When ***5*** appears press the ***PHASE/NEXT*** key once.
⇒ The password is **555.**

b. Press ***PHASE/NEXT*** each time **5** appears.



⇒ Once the password is entered , a ***0.*** will appear in the first row. The meter is now in Programming Mode, GROUP 0.

⇒ You are now in Programming Mode.
CONGRATULATIONS!

CHAPTER 15
General Procedure

To simplify things, programming tasks are logically bundled into nine major **GROUPS**. Located within each **GROUP** are specific meter **FUNCTIONS**.

1. Enter the Programming Mode.

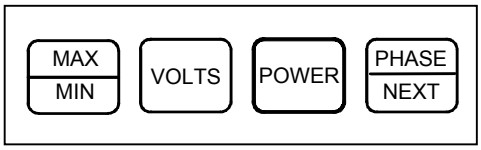
2. Select the appropriate GROUP.

3. Select the desired FUNCTION within the GROUP.

4. When the FUNCTION is selected, we can proceed with DATA ENTRY of the new value of the desired parameter.

5. Once the value is entered, the display returns to the selected FUNCTION, with the new value. From here you may move to another FUNCTION within the GROUP, exit the GROUP and proceed to a different GROUP for programming, or exit the Programming Mode entirely. To alter programming data permanently you must exit the Programming Mode (see Exiting the Programming Mode, Chapter 21)

15.1 Procedure



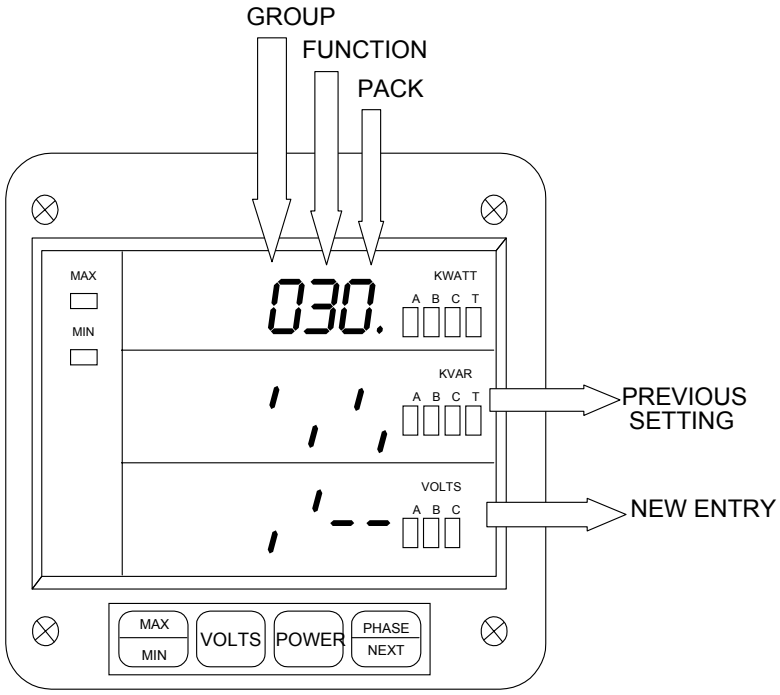
MAX/MIN	To scroll through GROUPS.
POWER	To activate a specific GROUP
MAX/MIN	To scroll through FUNCTIONS.
VOLTS	To scroll through packs within FUNCTIONS.
POWER	To activate data entry of FUNCTIONS or Switch PACKS.
VOLTS	To scroll through numbers or toggle segments.
POWER	To store selection and proceed to next.
MAX/MIN	To scroll through functions to exit point.
POWER	To exit GROUP.
MAX/MIN	To scroll through GROUPS to exit point.
POWER	To exit Programming Mode.

CHAPTER 16
Important Programming Notes

16.1 Standard Numeric Data Entry

Programmable FUNCTION values are always four digit numeric fields designed to accept any value between 0000 and 9999. When entering the value of a parameter you must enter all four digits, leading zero's included. For instance, if you need to enter the number 25, you must enter 0025.

16.2 Switch Packs



While Programming GROUPS are divided into FUNCTIONS, some FUNCTIONS are further divided into switch packs. These switch packs are a set of separate ON/OFF or toggle switches. These toggle switches have only two positions, either UP segment or DOWN segment. By setting the segment to UP or DOWN, you are turning a particular meter feature ON or OFF respectively.

CHAPTER 17
PROGRAMMING GROUP 0: Global Meter Setup

Programming Group *0*, The Global Meter Setup, includes Functions ***0*** through ***3,*** which control the configuration and basic operation of the DWVV. See Table 17-1 for a list of Group 0 Functions.

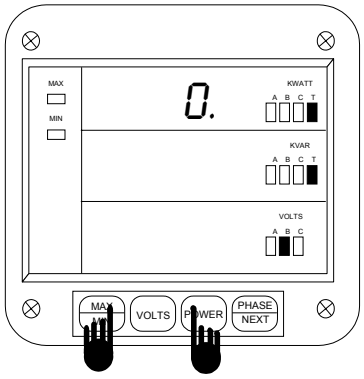
Table 17-1: Group 0 Programming Format

Function Number	Function
0.	Interval
1.	Meter Address for Communication
2.	Baud Rate for Communication
3.	System Configuration
E.	Exit Programming Group 0

17.1 Group 0, Function 0 - The Integration Interval

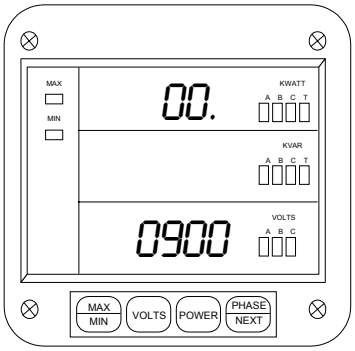
The Integration Interval is the time over which all instantaneous readings are averaged to obtain a maximum and minimum demand. The Integration Interval is entered in seconds. For example, if you would like to enter 15 minutes, enter 0900 seconds. To change the Integration Interval, follow the steps below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 14, Page 47 for details). If already in Group 0, proceed to Step 3.

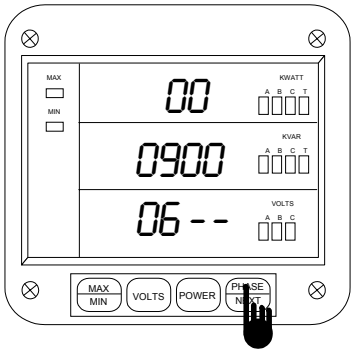


Step 2:
a. Press the ***MAX/MIN*** button until ***0.*** appears in the first row.

b. Press the ***POWER*** button to activate Group *0*.



Step 3:
⇒ The current value is displayed in the bottom level and the group and function number, here ***00.***, in the first row.

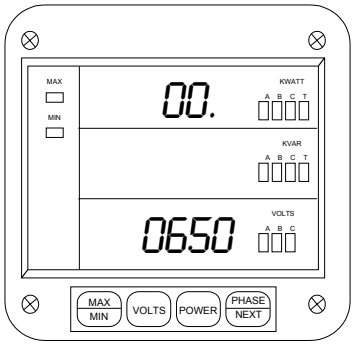


Step 4:
a. Press the ***POWER*** button once to begin the data entry sequence.

⇒ The previous value shifts to the middle row and the bottom row is replaced with four dashes.

b. Press the ***VOLTS*** button until the desired number appears.

c. Press the ***POWER*** button to store the digit and proceed to the next.



Step 5:
⇒ Repeat Step 4 until the desired value is entered.

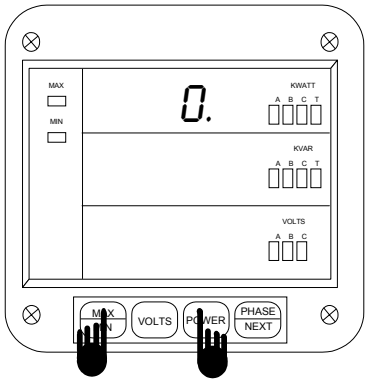
⇒ When complete, the new value is displayed in the lower row and the group and function number are displayed in the upper row.

See Chapter 21 to Exit.

17.2 Group 0, Function 1 - The Meter Address

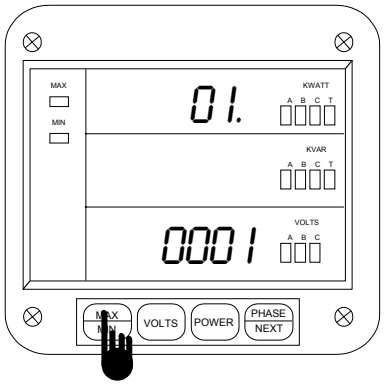
The Meter Address is used to identify the meter when it is communicating with a remote computer system. When there are numerous meters at one site it is essential that each have its own address. To change the Meter Address, follow the steps below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 14, Page 47 for details). If already in Group 0, proceed to Step 3.



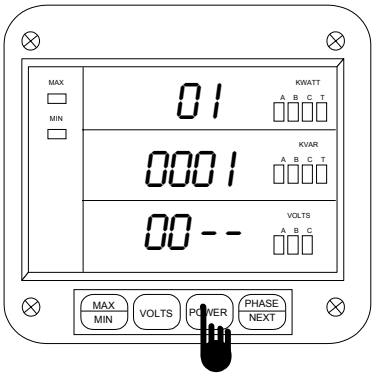
Step 2:
a. Press the ***MAX/MIN*** button until ***0.*** appears.

b. Press the ***POWER*** button to activate Group 0.



Step 3:
a. Press the ***MAX/MIN*** button until ***01.*** appears.

⇒ The current value is displayed in the bottom row.

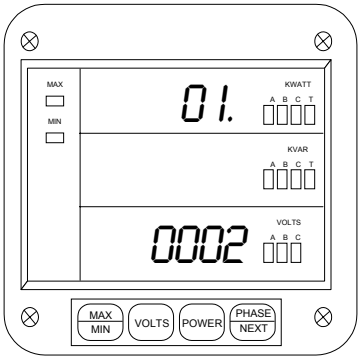


Step 4:
a. Press the ***POWER*** button once to begin the data entry sequence.

⇒ The previous value shifts to the middle display and four dashes appear in the bottom display.

b. Press the ***VOLTS*** button until the desired number appears.

c. Press the ***POWER*** button to store the digit and proceed to the next.



Step 5:
⇒ Repeat Step 4 until the desired value is entered.

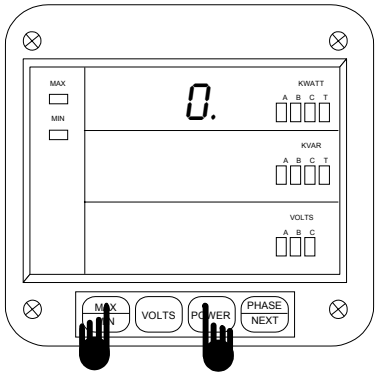
⇒ When complete, the new value is displayed in the lower level and the group and function number are displayed in the upper level.

See Chapter 21 to Exit.

17.3 Group 0, Function 2 - The Communication Baud Rate

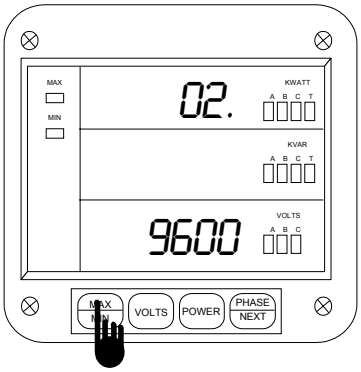
The Baud Rate is the speed at which data is transmitted between the meter and a remote computer or serial printer. The rate that is programmed into the meter must match the rate used by the remote device. Valid Baud Rates are 1200, 2400, 4800 and 9600. To change the Communication Baud Rate, follow the steps below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 14, Page 47 for details). If already in Group 0, proceed to Step 3.



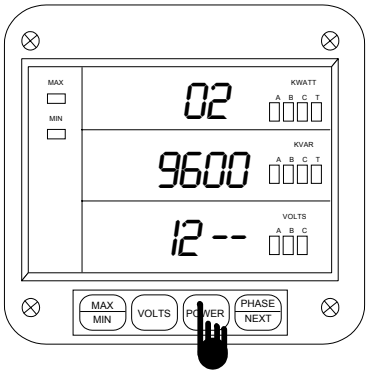
Step 2:
a. Press the ***MAX/MIN*** button until ***0.*** appears.

b. Press the ***POWER*** button to activate Group *0*.



Step 3:
a. Press the ***MAX/MIN*** button until ***02.*** appears.

⇒The current value is displayed in the bottom level.

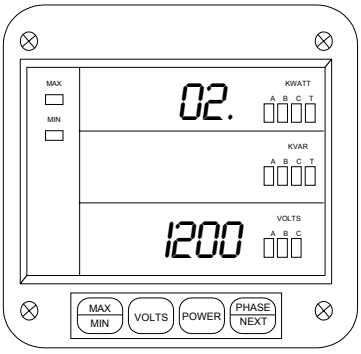


Step 4:
a. Press the ***POWER*** button once to begin the data entry sequence.

⇒ The previous value shifts to the middle row and the bottom row is replaced with four dashes.

b. Press the ***VOLTS*** button until the desired number appears.

c. Press the ***POWER*** button to store the digit and proceed to the next.



Step 5:
⇒ Repeat Step 4 until the desired value is entered.

⇒ When complete, the new value is displayed in the bottom row and the group and function number are displayed in the top row.

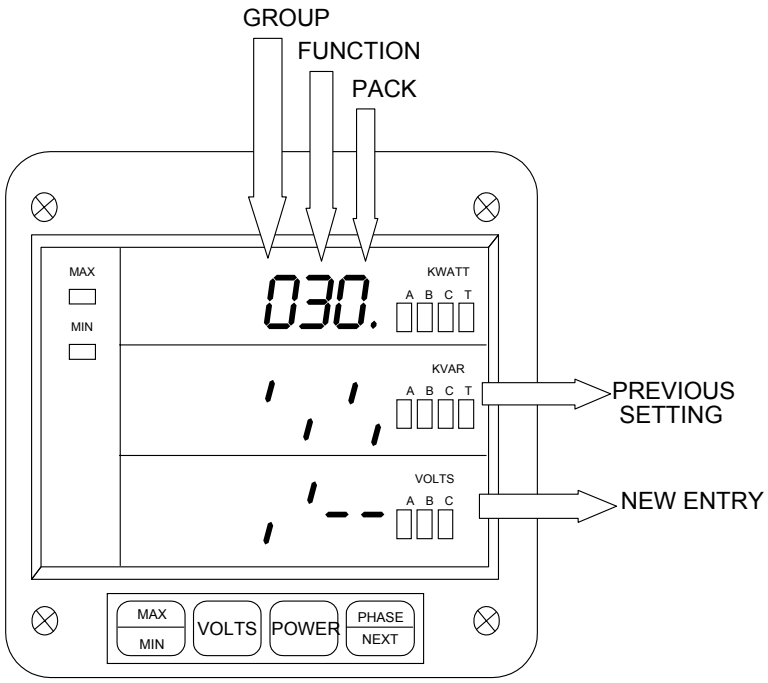
See Chapter 21 to Exit.

17.4 Group 0, Function 3 - System Configuration

The System Configuration is used to set the DWVV basic operation parameters. This Function utilizes Switch PACKS[1].

Function *3* contains four separate switch PACKS, numbered 0 - 3. Each PACK contains four individual UP/DOWN segments. Toggling the segment between UP and DOWN segments, toggles the switch ON or OFF, respectively.

The meter displays one Switch PACK at a time. Use the ***MAX/MIN*** button to scroll from PACK to PACK.



[1] *See SWITCH PACKS, Chapter 16 and Table 17-2 for further details.*

Table 17-2: System Configuration - Switch Features

PACK	SWITCH	FEATURE	SEGMENT POSITION
0	A	Reserved	-
	B	Reserved	-
	C	Reserved	-
	D	Reserved	-
1	A	Non-significant Blank Leading Zero	UP=Enable DOWN=Disable
	B	Reset Protection[2]	UP=Enable DOWN=Disable
	C	Reserved	-
	D	Open Delta Installation[3]	UP=Enable DOWN=Disable
2	A	Reserved	-
	B	Reserved	-
	C, D	MODBUS, EI-BUS and DNP 3.0 Protocols	EI-BUS Protocol: C is DOWN, D is DOWN. MODBUS Protocol, ASCII Framing: C is UP, D is UP. MODBUS Protocol, RTU Framing: C is DOWN, D is UP. DNP 3.0 Protocol: C is UP, D is DOWN.
3	A	Reserved	
	B	Reserved	
	C	Communications	UP=Enable DOWN=Disable
	D	DC Output or Print Operating and Programming Data[4]	UP=Enable DOWN=Disable

In order to print operating data (Access Mode 1) and programming data (Access Mode 2) both switches C and D from PACK 3 need to be enabled. Disabling prevents printing through the keypad only and will not affect print commands through communication. The print option should be disabled when using a multi-meter communications hookup, RS-485. Disabling prevents the user from corrupting data at a computer terminal while multiple meters are being polled.

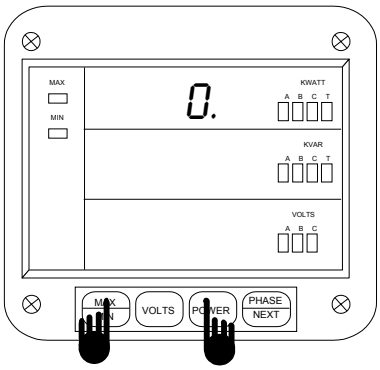
[2] *When enabled, use Protected Reset on Page 44.*

[3] *Enable when Open Delta System is installed (see Page 9).*

[4] *To print, PACK 3 SWITCHES C and D must both be enabled.*

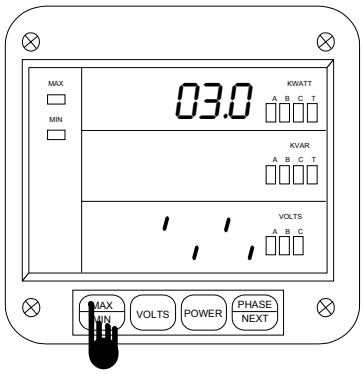
To change the System Configuration Switch Setting, follow the steps below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 14, Page 47 for details). If already in Group 0, proceed to Step 3.



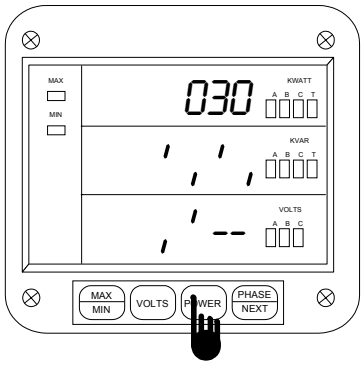
Step 2:
a. Press the ***MAX/MIN*** button until ***0.*** appears.

b. Press the ***POWER*** button to activate Group *0*.



Step 3:
a. Press the ***MAX/MIN*** button until ***030.*** appears.

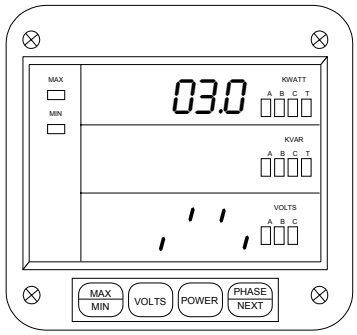
⇒ The current setting for PACK 0 is displayed in the bottom row.



Step 4:
a. Press the ***VOLTS*** button until the desired PACK is chosen.

b. Press the ***POWER*** button to activate the data entry sequence.

⇒ The previous setting shifts to the middle row and four dashes appear in the bottom row.



Step 5:
a. Press the ***VOLTS*** button to toggle segments for the desired settings.

⇒ Use the ***POWER*** button to store setting and proceed to the next.

⇒ Once all of the desired switches are set, the new setting will be displayed in the bottom row.

See Chapter 21 to Exit.

CHAPTER 18
PROGRAMMING GROUP 1: Full Scale Selection

Programming Group 1 Function provide a selection of Full Scale Settings for Volts and Amps to accommodate different CT'S and PT's that may be in use at the site. Scale selection may be performed in each of the functions. The site technician has a choice of Scale Selection between Volts and Kilovolts, Amps and Kiloamps, and Kilowatts and Megawatts.

Table 18-1: Group 1 Programming Format

FUNCTION NUMBER	FUNCTION
0.	Full Scale Selection for Volts
1.	Full Scale Selection for Amps
2.	Full Scale Selection for Watts
E.	Exit Programming Group 1

18.1 Group 1, Function 0 - Full Scale Setting for Voltage Channels and Decimal Point Placement for Voltages

NOTE: Due to the resolution capability of the DWVA, readings over 2000 counts will result in a less stable measurement.

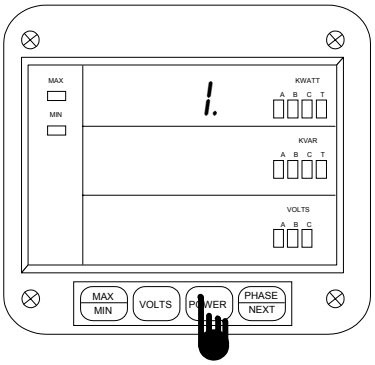
Table 18-2: Full Scale Settings for Volts

INPUT VOLTAGE	PT RATIO	FULL SCALE
75V(Suffix L)	120:1	9.00 KV
120/208 V	1:1 (Direct)	0120 V
120/208 V	4:1	0480 V
120/208 V	12:1	1.440 KV
277/480 V (Suffix G)	1:1 (Direct)	0300 V
120/208V	600:1	072.0 KV
120/208	1150:1	138.0 KV

NOTE: Decimal point placement for Volt and Amp channels is selected through Function 0 - Full Scale Volts and Function 1 - Full Scale Amps, respectively. The decimal position must be re-set each time these Functions are used.

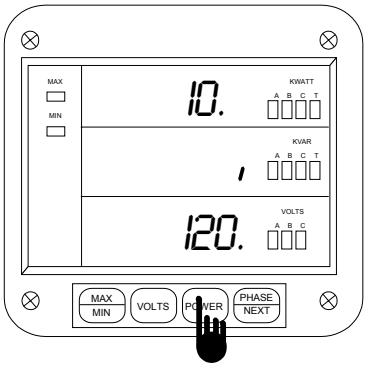
To change the Full Scale Settings follow the steps given below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 14, Page 47 for details). If already in Group 1, proceed to Step 3.



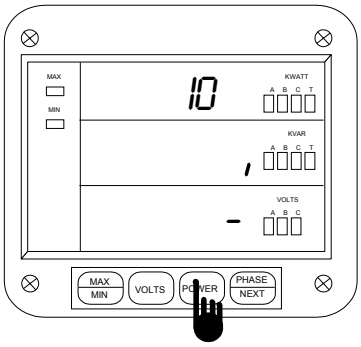
Step 2:
a. Press the ***MAX/MIN*** button until ***1.*** appears.

b. Press the ***POWER*** button to activate Group ***1.***



Step 3:
⇒ ***1 0*** appears in the top row.

⇒ The middle row displays the current Scale Factor Setting and the bottom row displays the current Full Scale for Volts.



ENTERING SCALE FACTOR

Step 4:
a. Press ***POWER*** to activate Scale Factor Entry.

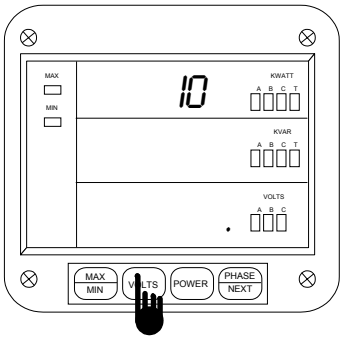
⇒ The previous value is displayed in the middle level and the bottom level is replaced with a single dash.

b. Press the ***VOLTS*** button to toggle the segment UP or DOWN, as desired.

⇒ UP indicates Kilovolts.

⇒ DOWN indicates Volts.

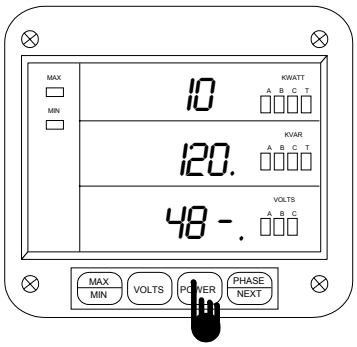
c. Press the ***POWER*** button to store and proceed to decimal point selection.



DECIMAL POINT SELECTION

Step 5:
⇒ Use the ***VOLTS*** button to move the decimal point to desired position.

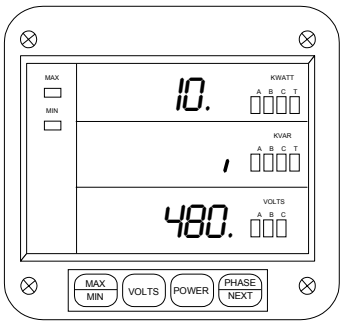
a. Press the ***POWER*** button to store and to proceed to entry of the Full Scale.



Step 6:
⇒ The previous value shifts to the middle display and the bottom display is replaced with four dashes

a. Press the ***VOLTS*** button until the desired number appears.

b. Press the ***POWER*** button to store and proceed to the next.



Step 7:
⇒ Repeat Step 6 until the desired value is entered.

⇒ When complete, the new value is displayed in the lower level.

- The unit segment is displayed in the middle level.
- The group and function number are displayed in the upper level.

To exit GROUP *1*, refer to Chapter 8, Exiting the Programming Mode

18.2 Group 1, Function 1 – Full Scale Selection for Current Channels and Decimal Point Placement for Current

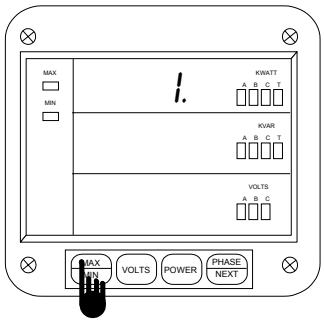
Table 18-3: Full Scale Settings for Amps

CT TYPE	FULL SCALE
Direct Input	0.500 A
600/5	0600 A
1000/5	1000 A
2000/5	2000 A
3000/5	03.00 KA
5000/5	05.00 KA

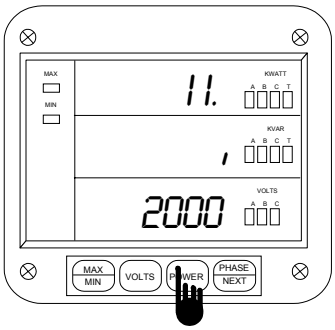
Also note that the meter reads with digital accuracy to a 2000 count range. So, all CT and PT Full Scale settings in the meter should reflect that limitation. The table above shows the proper settings.

To change the Full Scale Settings:

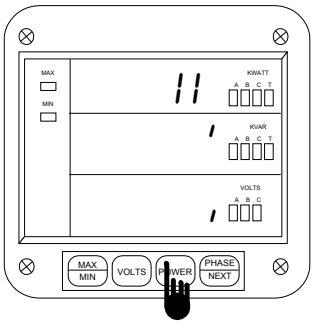
NOTE: Press ***MAX/MIN*** at any time to cancel before storing the last digit or switch.



Step 1:
a. Enter Group Level of Programming Mode (see Ch 8).
b. Press ***MAX/MIN*** until 1. appears in upper display.

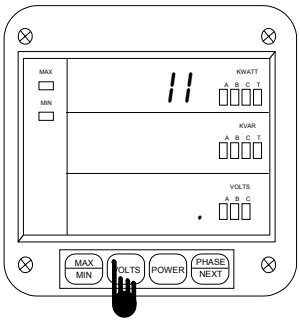


Step 2:
a. Press ***POWER*** to activate the Group.
b. Press ***MAX/MIN*** until 11. appears in the upper display.
⇒ Middle display indicates Scale Factor Setting.
⇒ Lower display indicates Full Scale.



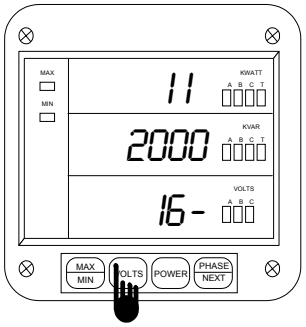
Step 3: (Entering the Scale Factor)
a. Press ***POWER*** to begin Data Entry Sequence.
⇒ Lower display is replaced with a single dash.

b. Press ***VOLTS*** to move the segment UP or DOWN to set Scale Factor.
⇒ UP signifies – Kiloamps.
⇒ DOWN signifies – Amps.
c. Press ***POWER*** to store.



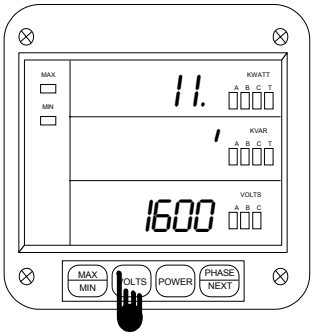
Step 4: (Decimal Point Selection)
a. Press ***VOLTS*** to move the decimal point.

b. Press ***POWER*** to store.



Step 5:
⇒ Middle display shows Full Scale for current.
⇒ Four dashes appear in lower display.
a. Press ***VOLTS*** to enter four-digit Full Scale.

b. Press ***POWER*** to store each digit.



⇒ Repeat this procedure until all four digits are entered.
⇒ Lower display indicates new Full Scale Setting.
⇒ Middle display indicates Scale Factor. Group and Function Number appear (including decimal point) in upper display.

18.3 Group 1, Function 2 - Scale Selection and Decimal Point Placement for Kilowatts/Megawatts

Programming Group 1 also provides decimal point positioning for maximum resolution. The following three examples are provided to aid in selecting the best decimal position for Function 2.

EXAMPLE 1:
Full Scale Voltage (FSV) = 120 V
Full Scale Amperage (FSA) = 5.00 A

Full Scale Wattage (FSW) is the product of FSV and FSA. For the FSW for three-phase, multiply the FSW by 3.

FSW (one phase) = 120 V • 5.00 A
FSW (one phase) = 600 W
FSW (three phase)= 600 W • 3 = 1,800 W

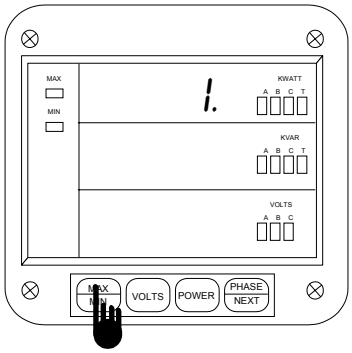
Here the FSW is too small a value for a Megawatt meter. FSW in the Kilowatt meter equals 1.800 KW. In Function *2*, place the decimal point after the first digit.

EXAMPLE 2: 480/120, 1000/5 CT
FSV = 480 V
FSA = 1000 A
FSW (one phase) = 480 V • 1000 A
FSW (one phase) = 480,000 W
FSW (three phase)= 480,000 W • 3 = 1,440,000 W

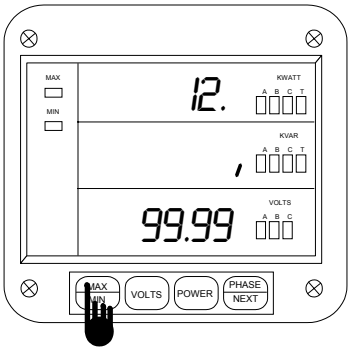
FSW for Kilowatt a meter equals 1440. KW. FSW for a Megawatt meter equals 1.440 MW. In Function 2 place the decimal point after the last digit for a Kilowatt meter and after the first digit for a Megawatt meter.

EXAMPLE 3:
FSV = 1.440 KV
FSA = 1000 A
FSW (one element) = 1440 V • 1000 A
FSW (one element) = 1,440,000 W
FSW (three element) = 1,440, 000 W • 3 = 4,320,000 W

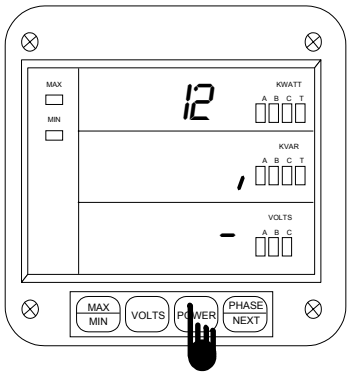
FSW for a Kilowatt meter equals 4320 KW. Here the FSW is too large a value for a Kilowatt meter (the range is 0 - 2000). FSW for a Megawatt meter equals 04.32 MW. In Function *2*, place the decimal point after the second digit. If not at Group Level of Programming Mode, use password entry sequence to begin (see Chapter 1, Page 21 for details). If already in Group 1, proceed to Step 3.



Step 1:
a. Press the ***MAX/MIN*** button until ***1.*** appears.
b. Press the ***POWER*** button to activate Group ***1.***



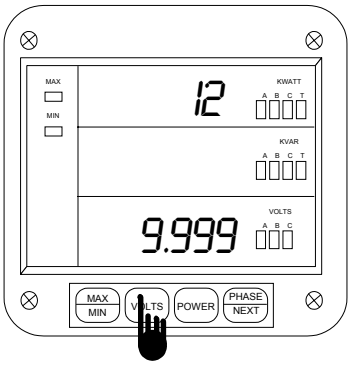
Step 2:
a. Press ***MAX/MIN*** until 12. appears.
⇨ Middle display indicates the current Scale Factor Setting,
⇨ Lower display indicates 9999 and Decimal Point Placement Settings.



Step 3: (Entering Scale Factor)
a. Press ***POWER*** to begin Data Entry Sequence.
⇨ Lower display is replaced with a single dash.

b. Press ***VOLTS*** to move the segment.
⇨ UP signifies – megawatts.
⇨ DOWN signifies - kilowatts.

c. Press ***POWER*** to store.



Step 4: (Decimal Point Selection)
⇨ Display blanks then lower display indicates 9999 and Decimal Point Placement Settings.

a. Press ***VOLTS*** to move decimal.

b. Press ***POWER*** to store.

See Chapter 21 to Exit.

CHAPTER 19
PROGRAMMING GROUP 2: Calibration

WARNING - READ THIS SECTION CAREFULLY BEFORE PROCEEDING

- *The calibration procedure requires highly accurate and stable input signals. Incorrect readings result from improper calibration procedures. If unsure, return the unit to the factory for calibration.*
- *BEFORE calibrating any channel, make a note of its Full Scale Setting (See Chapter 5). Set the Full Scale in accordance with **Table 19-2** for calibration. Restore original Full Scale Setting when calibration is completed.*
- *The first function in GROUP 2 (STD.CORR) is **NOT** to be changed by the user. Please make a note of the value here (□□□□) before using any other function in this group. If the STD.CORR value is inadvertently lost or changed, contact the factory for assistance.*

All sensitive electronic measuring devices may *drift* slightly over time and require periodic calibration. We recommend returning the meter to the factory on a yearly basis for proper calibration.

19.1 Calibration Requirements

FUNCTIONS *0-8* (High and Low End Calibration) can be calibrated by qualified site technicians, if a stable calibration source can be applied. Otherwise, the meter should be checked for linearity and accuracy, annually. Calibrate if necessary.

Calibration on the DWVV requires precise inputs of 120 Volts, 5 Amps, and 2.5 Amps. The DWVV-G model requires precise inputs of 300 Volts, 5 Amps, and 2.5 Amps. If this equipment is unavailable, contact the factory for assistance.

Table 19-1: Group 2 Programming Format

FUNCTION NUMBER	FUNCTION
P.	Standard Correction - Factory Procedure only.
0.	High End Calibration - Volts AN
1.	High End Calibration - Volts BN
2.	High End Calibration - Volts CN
3.	High End Calibration - Amps A
4.	High End Calibration - Amps B
5.	High End Calibration - Amps C
6.	Low End Calibration - Amps A
7.	Low End Calibration - Amps B
8.	Low End Calibration - Amps C
E.	Exit Programming GROUP 2

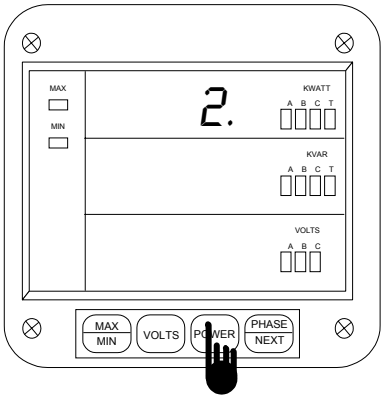
The Full Scale and Calibration values should be equal during the calibration procedure. Refer to Table 19-2 for examples of Full Scale and Calibration settings.

Table 19-2: Calibration Source, Full Scale and Value Settings for Calibration

Calibration Type/Ranges	Calibration Source	Full Scale Setting/Scale Factor	Calibration Value
Volts 75 V	75 V	075.0 V	075.0
Volts 120.13/`1 PT	75 V	9.01 KV	09.01
Volts 120/208 V	120 V	0120 V	0120
Volts 4/1 PT	120 V	0480 V	0480
Volts 60/1 PT	120 V	07.20 KV	07.20
Volts 277/480 V	300 V	0300 V	0300
Amps Hi End 1000/5 CT	5 A	1000 A	1000
Amps Hi End 5000/5 CT	5 A	5.00 KA	05.00
Amps Lo End 1000/5 CT	2.5 A		0500
Amps Lo End 5000/5 CT	2.5 A		02.50

19.2 Group 2, Functions 0-8 - High End Calibration of Voltage Channels, High and Low End Calibration of Amperage Channels

⇨To change the **CALIBRATION**, follow these steps:



Step 1:
a. Enter Group Level of Programming Mode.

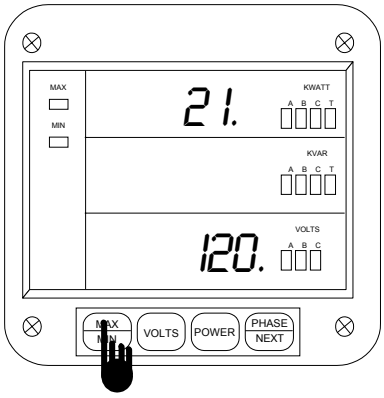
b. Press ***MAX/MIN*** until ***2.*** appears in upper display.

c. Press ***POWER*** to activate the Group.

⇨A one-digit password is required to continue.

d. Press ***VOLTS*** until ***5*** appears.

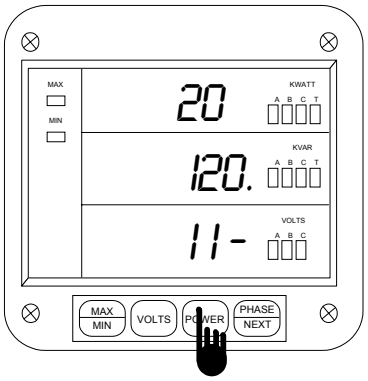
e. Press ***POWER*** to select.



Step 2:
⇨Refer to **Table 19-1** for Function Number that corresponds to channel requiring calibration.

a. To calibrate Volts BN, press ***MAX/MIN*** until ***21.*** appears in upper display.

(2P. is pre-calibrated. This is a factory set value and should not be altered).



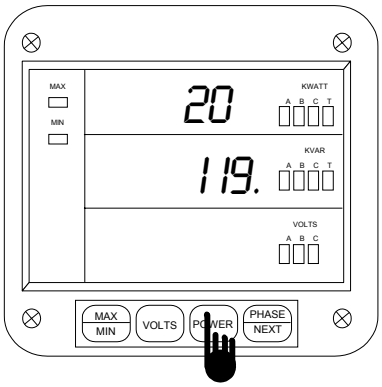
Step 3:
⇨At this time the calibration source should be applied to the appropriate channel.

a. Press ***POWER*** to activate calibration.

⇨The current value move to middle display and the lower display is replaced with four dashes.

b. Press ***VOLTS*** to scroll through the numbers.

c. Press ***POWER*** to store.



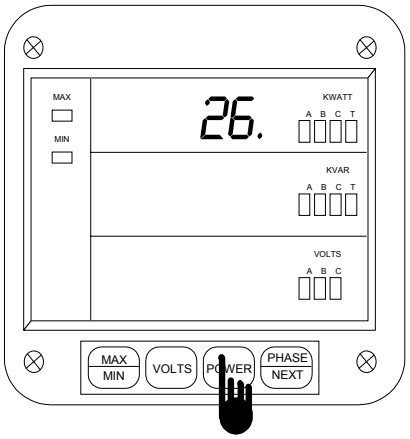
Step 4:
⇨When the entry is complete, the new value moves to the middle display.

⇨The lower display indicates the calibration reading after 10-15 seconds.

a. Press ***MAX/MIN*** to end the calibration sequence.

REPEAT THE SAME PROCEDURE FOR FUNCTION 0 - 5.

FOR FUNCTION 6, FOLLOW THESE STEPS:



Step 1:
⇨Set the source to half of the current Hi End Scale.

a. Press ***MAX/MIN*** until ***26.*** appears in upper display.

b. Press ***POWER*** to activate.

⇨The middle and lower displays blank.

⇨After 10 seconds the calibrated number appears momentarily.

Step 2:
⇨ When the entry is complete the new values moves to the middle display.

⇨ The lower display indicates the calibrated reading after 10-15 seconds.

a. Press ***MAX/MIN*** to end the Calibration Procedure.

You cannot cancel at this time.

CHAPTER 20
PROGRAMMING GROUP 3: Correction Ratios

The DWVV is constructed with two separate modules, joined by a connector and secured with two screws. The front module (*meter module*) contains the microprocessors, displays, and related circuitry, and the rear (*input module*) supports all incoming signal connections. The sections can be easily separated, allowing the meter module to be moved, or serviced, off-site without interrupting service loops or removing meter connections.

Though a lot simpler in design, the input module does contain some step down circuitry. Due to normal CT tolerance and resistance limitations, small channel offsets unique to each input module can be seen. *They are measured at the factory and printed on the face of the input (rear) module. We refer to them as* ***CORRECTION RATIOS****.*

The Programming Mode makes it possible to key in the CORRECTION RATIO values of any input module to which the meter is attached. This allows a site technician to move a meter to a different input module, re-program the correction ratios and resume accurate power metering.

Warning: An Incorrect entry will result in false readings.

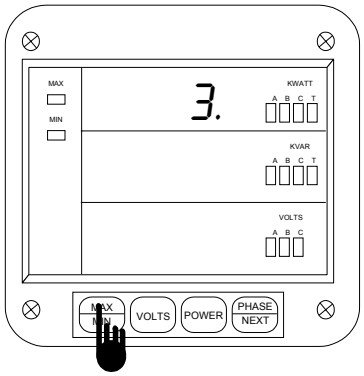
Table 20-1: Group 3 Programming Format

Function Number	Function
0.	Hi End Correction Ratio, Volts AN
1.	Hi End Correction Ratio, Volts BN
2.	Hi End Correction Ratio, Volts CN
3.	Hi End Correction Ratio, Amps A
4.	Hi End Correction Ratio, Amps B
5.	Hi End Correction Ratio, Amps C
6.	Low End Correction Ratio, Amps A
7.	Low End Correction Ratio, Amps B
8.	Low End Correction Ratio, Amps C
e.	Exit Programming Group 3

20.1 Group 3, Functions 0-2 - Hi End Correction Ratios

To change the Correction Ratio, follow the steps below:

Step 1:
If not at Group Level of the Programming Mode, use password entry sequence to begin (see Chapter 14, Page 47 for details). If already in Group 3, proceed to Step 3.



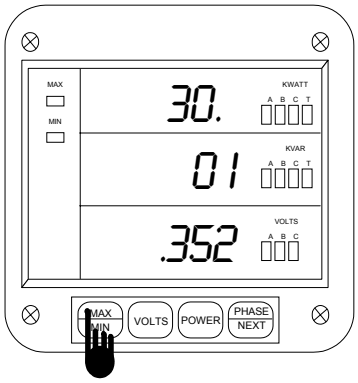
Step 2:
a. Press the ***MAX/MIN*** button until ***3.*** is displayed.

b. Press the ***POWER*** button to activate.

⇒ A one-digit password is required to continue.

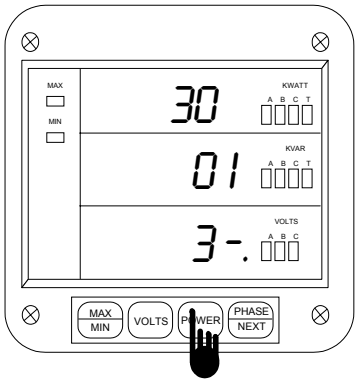
c. Press the ***VOLTS*** button until ***5*** appears

d. Press ***POWER*** to select.



Step 3:
a. Press ***MAX/MIN*** button to select the desired function (*0-8*).

⇒The middle level displays the integer portion and the bottom level displays the fractional portion of the ratio.

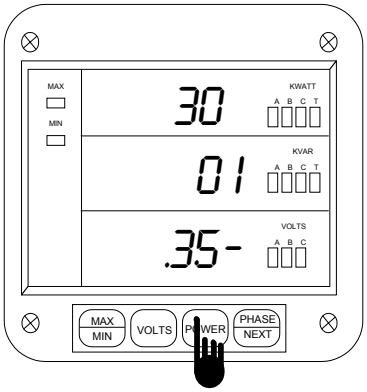


Step 4:
a. Press ***POWER*** to begin entering the integer portion of the new ratio.

⇒ Two dashes appear on the bottom level. *(To skip to changing the fractional portion press MAX/MIN once and proceed to Step 5.)*

b. Use the ***VOLTS*** button to scroll through numbers

c. Press ***POWER*** to select the number[1] and proceed to the next.



Step 5:
⇒ Entering the fractional portion of the ratio repeat Step 4.

a. Use the ***VOLTS*** button to scroll through numbers

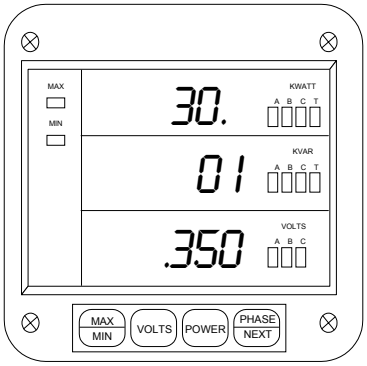
b. Press ***POWER*** to select the number[2] and proceed to the next.

[1] *To cancel at any time, press **L-N/L-L** twice.*

[2] *To cancel at any time, press **L-N/L-L** once.*

Step 6:
⇒ When the new ratio is complete the meter replaces the old correction ratio with the new.

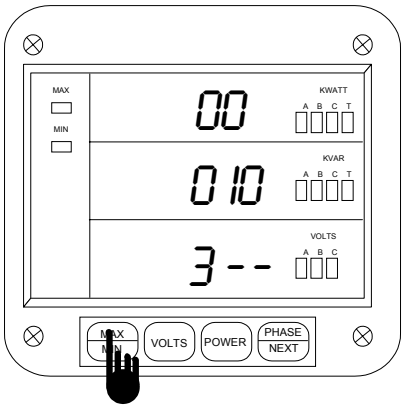
⇒ The middle level displays the integer portion and the bottom level displays the fractional portion of the ratio.



To exit Group *3*, refer to *Chapter 21, Exiting the Programming Mode.*

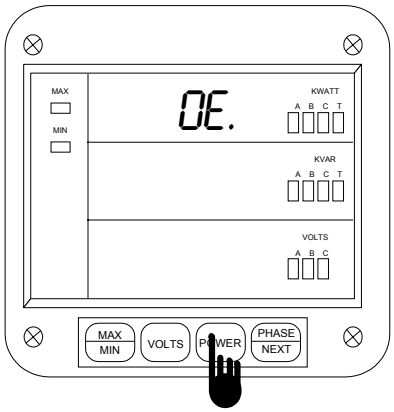
CHAPTER 21
Exiting The Programming Mode

The steps for exiting the Programming Mode will vary depending upon which stage of programming you are in. If you are in the Data Entry Sequence begin at Step 1. If you are in the Function Level begin at Step 2. If you are in the Group Level begin at Step 3.



Step 1:
EXITING FROM DATA ENTRY SEQUENCE

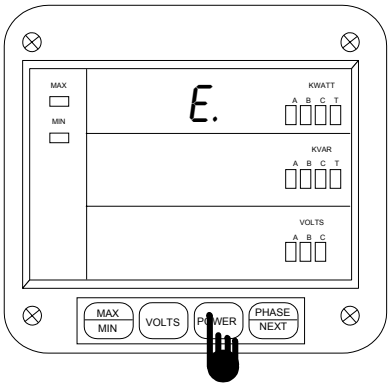
a. Press the ***MAX/MIN*** button to cancel the Data Entry Sequence. The DWVA/DWVV* will return to the Function Level.



Step 2:
EXITING FROM FUNCTION LEVEL

a. Press the ***MAX/MIN*** button until the Group number in the top display is followed by ***E.***

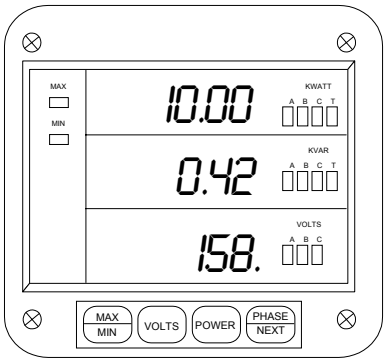
b. Press the ***POWER*** button to exit from the Function Level to the Group Level.



Step 3:
EXITING THE GROUP LEVEL

a. Press the ***MAX/MIN*** button until ***E.*** appears in the upper row.

b. Press the ***POWER*** button to exit entirely from the Programming Mode.



Step 4:

⇒ You have exited the Programming Mode. After a moment the meter will return to the Operating Mode.

NOTE: The Keypad for the DWVA and the DWVV meters are the same except:
DWVA Keypad has an AMPS button.
DWVV Keypad has a VOLTS button.