

Digital Multifunction Electricity Meter

Application Notes

Publication 1083-608
Rev. A
May 2002

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Important Safety Notice

Installation, operation, and maintenance of this product can present potentially hazardous conditions if safety procedures are not followed. To ensure that this product is used safely, it is important that you:

- Review, understand, and observe all safety notices and recommendations within this manual.
- Review your company safety procedures for meter installation and service.

DANGER!

Hazardous voltages are present during normal servicing of this device that can cause severe injury or death. These voltages are present throughout the utility's potential transformer (PT) and current transformer (CT) circuits, and the meter's connection terminals. Only qualified, properly trained personnel should perform installation and servicing on this equipment.

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INTRODUCTION

The JEMStar meter is a very user-friendly meter, with most features and operating functions being self-explanatory. Once you become familiar with the basic operation of the front panel pushbuttons and the simple Windows™ software menus, you can read, configure and create reports from the data collected by the meter. Hardware and software instruction manuals, and a Windows Help system are included to assist you with detailed explanations of the extensive operating features of JEMStar.

This document is intended to assist the advanced user by providing some insight into the *application* of JEMStar's features. The topics and suggestions contained herein represent a collection of user's requests and experiences with the meter. We hope that this will provide a forum to expand your knowledge, and at the same time, keep us in touch with your metering needs. We welcome your thoughts and requests, and we would be interested in discussing the future of utility metering with you. Our toll-free 800 number, listed on the cover, is available for your use.

TRANSMISSION LINE LOSS CALCULATION

It is possible to perform line loss compensation for line losses on the primary side of the main transformer. You should be familiar with JEMWare operation and the use of the Transformer Loss Compensation (TLC) feature. If not, review this section in the JEMWare manual (publication 1083-602) before proceeding.

Presently, the line resistance entered in the JEMWare TLC window is applied to the primary side of the PT and CT (the secondary side of the main transformer). To perform line loss compensation on the primary side of the main transformer, do the following.

In the JEMWare TLC window, enter the primary line resistance divided by the square of the transformer turns ratio, where the turns ratio is given as primary turns/secondary turns.

$$R = \text{Primary Line Resistance} / (\text{turns ratio})^2$$

Where: R = resistance to be entered into JEMWare TLC screen in ohms
 Primary Line Resistance = primary side line resistance in ohms
 Turns ratio = main transformer turns ratio = primary turns/secondary turns

JEMSTAR TRANSFORMER AND LINE LOSS COMPENSATION FORMULAE AND TECHNICAL DESCRIPTION

The following describes the methods and equations used by the JEMStar meter and JEMWare software to implement transformer and line loss compensation. An actual example using a Form 9 meter is illustrated at the end of the discussion.

A. DATA REQUIRED FOR TRANSFORMER AND LINE LOSS COMPUTATION

TRANSFORMER AND LINE DATA

JEMWare allows single phase or multi-phase computation of TLC. For the purposes of this example, each value is a transformer per phase value. As described in JEMWare manual 1083-602, the following parameters must be entered into the Loss Compensation window (item 7 is only required if computing Line Loss).

1. RATED VOLT AMPS V_{A_T}
2. RATED VOLTAGE V_T
3. FE LOSS @ NO LOAD NLW

- | | |
|------------------------|-------|
| 4. CU LOSS @ FULL LOAD | FLW |
| 5. EXCITING CURRENT | %EC |
| 6. IMPEDANCE | %I |
| 7. LINE RESISTANCE | R_L |

NOTES:

1. Form 6, 8, 9 & Form 5 (3 wire delta and 3 wire Y):
In the case of three-phase transformer and line loss data, divide the total three phase data values for items 1, 3, 4, and 7 by three to enter transformer data on a per-phase basis. Data values for items 2, 5, and 6 remain the same whether using three-phase total or individual phase calculations.
2. Form 5 (open delta and network):
In the case of two-phase transformer and line loss data, divide total two phase data values for items 1, 3, 4, and 7 by two to enter transformer data on a per phase (phases A and C only) basis. Data values for items 2, 5, and 6 remain the same whether using three-phase total or individual phase calculations.
3. Iron losses are related to the transformer phase voltage.
Copper losses are related to the transformer phase current.

METER AND INSTRUMENT TRANSFORMER DATA

The following parameters are used in the computation of TLC coefficients.

- | | | |
|-----------------------|--------------|---|
| PT RATIO | PT_{RATIO} | (from JEMWare Primary Config screen) |
| CT RATIO | CT_{RATIO} | (from JEMWare Primary Config screen) |
| NOMINAL METER VOLTAGE | V_{METER} | (from JEMWare Primary Config screen) |
| METER TEST CURRENT | I_{METER} | (from JEMWare Loss Compensation screen) |

B. TLC EQUATIONS

JEMStar calculates loss watts and VARs based on the following formulas:

$$\text{IRON LOSS WATTS} = K_{\text{WFE}} \times V^2$$

$$\text{COPPER LOSS WATTS} = K_{\text{WCU}} \times I^2$$

$$\text{IRON LOSS VARS} = K_{\text{VFE}} \times V^4$$

$$\text{COPPER LOSS VARS} = K_{\text{VCU}} \times I^2$$

Where “V” is the voltage across and “I” is the current through each phase of the transformer.

K_{WFE} , K_{WCU} , K_{VFE} , K_{VCU} are coefficients calculated by JEMWare and downloaded to the JEMStar meter during configuration. Each meter element (per phase) watt and VAR reading is compensated individually. NOTE: The values for these coefficients are displayed on the JEMWare CONSTANTS page of the Loss Compensation screen, and are scaled for the JEMWare internal circuitry and mathematical requirements. The values calculated in this example are not scaled and will not be equivalent to those displayed by JEMWare.

C. JEMWare CALCULATION OF TLC COEFFICIENTS

First, we must define a few terms used in the following description of TLC coefficient calculation.

Transformer phase: refers in this description to an individual leg of a multi-phase transformer or a single transformer of a multi-phase bank.

Meter element: refers to an internal meter input consisting of a current and voltage input pair. It is important to note for purposes of TLC that for certain meter forms, there is not a direct correlation between transformer phases and meter elements.

Forms 6, and 9: Three transformer phases A, B, C measured with three internal meter elements A, B, C (Form 6 is a 2 ½ element meter, but the missing phase voltage is reconstructed digitally.). The meter elements directly measure the transformer phase voltages and currents.

Form 8: Three transformer phases A, B, C measured with three internal meter elements A, B, C. However, because of the delta configuration, the meter elements measure transformer line currents (not phase currents) and because the

voltages are measured with respect to neutral, none of the meter voltages correspond directly to the voltage across the transformer secondary windings.

Form 5 (3 wire delta): Three transformer phases A, B, C measured with two internal meter elements A and C. The meter elements measure the phase voltages and the line currents (not phase currents).

Form 5 (3 wire Y): Three transformer phases A, B, C measured with two internal meter elements A and C. The meter elements measure the phase currents and the line-line voltage (not phase voltages).

Form 5 (open delta and network): Two transformer phases A and C measured with two internal meter elements A and C. The meter elements directly measure the transformer phase voltages and currents.

The JEMStar meter performs loss compensation at the individual element level. JEMStar calculates and compensates the watts and VAR measurements for each meter element individually, so each meter element has its own TLC coefficients. The individual element compensated watt and VAR measurements are then summed to form the total system measurement. In all cases except Form 8, the TLC coefficients for each of the meter elements are identical in value.

The general calculation steps are as follows:

1. JEMWare calculates the transformer watts and VAR losses on a per transformer phase basis when the meter is running at its nominal voltage and test current.
2. The program sums the transformer per phase losses resulting in the total system losses.
3. The program apportions the total system losses among the meter elements and calculates TLC coefficients for each internal meter element.

Forms 6 and 9: $\frac{1}{3}$ of the system losses are apportioned to each of the 3 meter elements.

Form 5: $\frac{1}{2}$ of the system losses are apportioned to each of the 2 meter elements.

Form 8: $\frac{1}{3}$ of the system copper watt and VAR losses are apportioned to each of the 3 internal meter elements. Approximately 73% of the system iron watt and VAR losses are apportioned to element A, with the remaining iron losses split evenly between elements B and C. This compensates for the fact that phase A measures a voltage that is 208/120 higher than phases

B and C, and for the fact that none of the elements directly measure the line-to-line transformer voltage.

4. When the TLC feature is “Enabled“ in the JEMWare configuration, these losses will be added to or subtracted from the JEMStar per phase watt and VAR readings (Adding or subtracting depends on the configuration settings). The total 3 phase system losses are simply the sum of the three per phase losses and are added to or subtracted from the polyphase watt and VAR reading.

D. TYPICAL EXAMPLE CALCULATIONS

The following equations illustrate the TLC coefficient calculations for a FORM 9 meter:

a. FE WATTS LOSS (K_{WFE})

Transformer iron watts loss when meter is running at nominal voltage:
(calculated for each of 3 transformer phases)

$$LWFE_{\text{phase}} = (V_{\text{METER}} \times PT_{\text{RATIO}} / V_T)^2 \times NLW$$

Percent Loss: (calculated for each of 3 transformer phases)

$$\%LWFE_{\text{phase}} = 100 \times LWFE_{\text{phase}} / (V_{\text{METER}} \times PT_{\text{RATIO}} \times I_{\text{METER}} \times CT_{\text{RATIO}})$$

Sum the $LWFE_{\text{phase}}$ results and apportion 1/3 of the system losses ($LWFE_{\text{avg}}$) to each of the 3 meter elements.

Calculate TLC coefficient: (calculated for each of 3 meter elements)

$$K_{WFE} = LWFE_{\text{avg}} / (V_{\text{METER}} \times PT_{\text{RATIO}})^2$$

b. CU WATTS LOSS (K_{WCU})

Calculate transformer test current:

$$I_T = VA_T / V_T$$

Transformer copper watts loss when meter is running at nominal (test) current: (calculated for each of 3 transformer phases)

$$\text{Transformer } LW_{CUTX_{\text{phase}}} = (I_{\text{METER}} \times CT_{\text{RATIO}} / I_T)^2 \times FLW$$

Line watts loss when meter is running at nominal (test) current:
(calculated for each of 3 transformer phases)

$$LWCULINE_{\text{phase}} = (I_{\text{METER}} \times CT_{\text{RATIO}})^2 \times R_L$$

Total transformer and line losses: (calculated for each of 3 transformer phases)

$$LWCU_{\text{phase}} = LWCUTX_{\text{phase}} + LWCULINE_{\text{phase}}$$

Percent Loss: (calculated for each of 3 transformer phases)

$$\%LWCU_{\text{phase}} = 100 \times LWCU_{\text{phase}} / (V_{\text{METER}} \times PT_{\text{RATIO}} \times I_{\text{METER}} \times CT_{\text{RATIO}})$$

Sum the $LWCU_{\text{phase}}$ results and apportion 1/3 of the system losses ($LWCU_{\text{avg}}$) to each of the 3 meter elements.

Calculate TLC coefficient: (calculated for each of 3 meter elements)

$$K_{WCU} = LWCU_{\text{avg}} / (I_{\text{METER}} \times CT_{\text{RATIO}})^2$$

c. FE VARS LOSS (K_{VFE})

Transformer test VA losses. (calculated for each of 3 transformer phases)

$$NLVA_{\text{phase}} = (\%EC \times VA_T) / 100$$

Transformer test VAR losses. (calculated for each of 3 transformer phases)

$$NLVAR_{\text{phase}} = \text{sqrt}(NLVA_{\text{phase}}^2 - NLW^2)$$

Transformer iron VARs loss when meter is running at nominal voltage: (calculated for each of 3 transformer phases)

$$LVFE_{\text{phase}} = (V_{\text{METER}} \times PT_{\text{RATIO}} / V_T)^4 \times NLVAR_{\text{phase}}$$

Percent Loss: (calculated for each of 3 transformer phases)

$$\%LVFE_{\text{phase}} = 100 \times LVFE_{\text{phase}} / (V_{\text{METER}} \times PT_{\text{RATIO}} \times I_{\text{METER}} \times CT_{\text{RATIO}})$$

Sum the $LVFE_{\text{phase}}$ results and apportion 1/3 of the system losses ($LVFE_{\text{avg}}$) to each of the 3 meter elements.

Calculate TLC coefficient: (calculated for each of 3 meter elements)

$$K_{VFE} = LVFE_{\text{avg}} / (V_{\text{METER}} \times PT_{\text{RATIO}})^4$$

d. CU VARS LOSS (K_{VCU})

Transformer test VA losses. (calculated for each of 3 transformer phases)

$$FLVA_{\text{phase}} = (\%I \times VA_T) / 100$$

Transformer test VAR losses. (calculated for each of 3 transformer phases)

$$FLVAR_{\text{phase}} = \text{sqrt}(FLVA_{\text{phase}}^2 - FLW^2)$$

Transformer copper VARs loss when meter is running at nominal (test) current: (calculated for each of 3 transformer phases)

$$LVCU_{\text{phase}} = (I_{\text{METER}} \times CT_{\text{RATIO}} / I_T)^2 \times FLVAR_{\text{phase}}$$

Percent Loss: (calculated for each of 3 transformer phases)

$$\%LVCU_{\text{phase}} = 100 \times LVCU_{\text{phase}} / (V_{\text{METER}} \times PT_{\text{RATIO}} \times I_{\text{METER}} \times CT_{\text{RATIO}})$$

Sum the $LVCU_{\text{phase}}$ results and apportion 1/3 of the system losses ($LVCU_{\text{avg}}$) to each of the 3 meter elements.

Calculate TLC coefficient: (calculated for each of 3 meter elements)

$$K_{\text{VCU}} = LVCU_{\text{avg}} / (I_{\text{METER}} \times CT_{\text{RATIO}})^2$$

e. NUMERICAL EXAMPLE (Form 9)

PER PHASE TRANSFORMER AND LINE LOSS DATA

		Phase A	Phase B	Phase C
RATED VOLT AMPS	VA_T	9,000,000	9,000,000	9,000,000
RATED VOLTAGE	V_T	7967	7967	7967
FE LOSS @ NO LOAD	NLW	7961.3	7961.3	7961.3
CU LOSS @ FULL LOAD	FLW	24,945.7	24,945.7	24,945.7
EXCITING CURRENT	$\%EC$	0.353	0.353	0.353
IMPEDANCE	$\%I$	14.49	14.49	14.49
LINE RESISTANCE (ohms)	R_L	0.05	0.05	0.05

METER AND INSTRUMENT TRANSFORMER DATA

PT RATIO	PT_{RATIO}	66:1
CT RATIO	CT_{RATIO}	200:1
NOMINAL METER VOLTAGE	V_{METER}	120 volts
METER TEST CURRENT	I_{METER}	10 amps

FE WATTS LOSS (K_{WFE})

Transformer iron watts loss when meter is running at nominal voltage:
(calculated for each of 3 transformer phases)

$$LWFE_{phase} = (120 \times 66 / 7967)^2 \times 7961.3 = 7867.6 \text{ for each phase}$$

Percent Loss: (calculated for each of 3 transformer phases)

$$\%LWFE_{phase} = 100 \times 7867.6 / (120 \times 66 \times 10 \times 200) = 0.05\% \text{ for each phase}$$

Sum the $LWFE_{phase}$ results and apportion 1/3 of the system losses ($LWFE_{avg}$) to each of the 3 meter elements.

$$LWFE_{avg} = (7867.6 + 7867.6 + 7867.6) / 3 = 7867.6$$

Calculate TLC coefficient: (calculated for each of 3 meter elements)

$$K_{WFE} = 7867.6 / (120 \times 66)^2 = 0.00012543 \text{ for each meter element}$$

CU WATTS LOSS (K_{WCU})

Calculate transformer test current:

$$I_T = 9,000,000 / 7967 = 1129.66$$

Transformer copper watts loss when meter is running at nominal (test) current: (calculated for each of 3 transformer phases)

$$\text{Transformer LWCUTX}_{\text{phase}} = (10 \times 200 / 1129.66)^2 \times 24,945.7 = 78,191.6 \text{ for each phase}$$

Line watts loss when meter is running at nominal (test) current:
(calculated for each of 3 transformer phases)

$$\text{LWCULINE}_{\text{phase}} = (10 \times 200)^2 \times 0.05 = 200,000 \text{ for each phase}$$

Total transformer and line losses: (calculated for each of 3 transformer phases)

$$\text{LWCU}_{\text{phase}} = 78,191.6 + 200,000 = 278,191.6 \text{ for each phase}$$

Percent Loss: (calculated for each of 3 transformer phases)

$$\% \text{LWCU}_{\text{phase}} = 100 \times 278,191.6 / (120 \times 66 \times 10 \times 200) = 1.76\% \text{ for each phase}$$

Sum the $\text{LWCU}_{\text{phase}}$ results and apportion 1/3 of the system losses (LWCU_{avg}) to each of the 3 meter elements.

$$\text{LWCU}_{\text{avg}} = (278,191.6 + 278,191.6 + 278,191.6) / 3 = 278,191.6$$

Calculate TLC coefficient: (calculated for each of 3 meter elements)

$$K_{\text{WCU}} = 278,191.6 / (10 \times 200)^2 = 0.06955 \text{ for each meter element}$$

FE VARS LOSS (K_{VFE})

Transformer test VA losses. (calculated for each of 3 transformer phases)

$$\text{NLVA}_{\text{phase}} = (0.353 \times 9,000,000) / 100 = 31,770 \text{ for each phase}$$

Transformer test VAR losses. (calculated for each of 3 transformer phases)

$$\text{NLVAR}_{\text{phase}} = \text{sqrt}(31,770^2 - 7961.3^2) = 30,756.3 \text{ for each phase}$$

Transformer iron VARs loss when meter is running at nominal voltage:
(calculated for each of 3 transformer phases)

$$\text{LVFE}_{\text{phase}} = (120 \times 66 / 7967)^4 \times 30,756.3 = 30,036.9 \text{ for each phase}$$

Percent Loss: (calculated for each of 3 transformer phases)

$$\%LVFE_{\text{phase}} = 100 \times 30,036.9 / (120 \times 66 \times 10 \times 200) = 0.19\% \text{ for each phase}$$

Sum the $LVFE_{\text{phase}}$ results and apportion 1/3 of the system losses ($LVFE_{\text{avg}}$) to each of the 3 meter elements.

$$LVFE_{\text{avg}} = (30,036.9 + 30,036.9 + 30,036.9) / 3 = 30,036.9$$

Calculate TLC coefficient: (calculated for each of 3 meter elements)

$$K_{VFE} = 30,036.9 / (120 \times 66)^4 = 7.634 \times 10^{-12} \text{ for each meter element}$$

CU VARS LOSS (K_{VCU})

Transformer test VA losses. (calculated for each of 3 transformer phases)

$$FLVA_{\text{phase}} = (14.49 \times 9,000,000) / 100 = 1,304,100 \text{ for each phase}$$

Transformer test VAR losses. (calculated for each of 3 transformer phases)

$$FLVAR_{\text{phase}} = \text{sqrt}(1,304,100^2 - 24,945.7^2) = 1,303,861 \text{ for each phase}$$

Transformer copper VARs loss when meter is running at nominal (test) current: (calculated for each of 3 transformer phases)

$$LVCU_{\text{phase}} = (10 \times 200 / 1129.66)^2 \times 1,303,861 = 4,086,917 \text{ for each phase}$$

Percent Loss: (calculated for each of 3 transformer phases)

$$\%LVCU_{\text{phase}} = 100 \times 4,086,917 / (120 \times 66 \times 10 \times 200) = 25.80\% \text{ for each phase}$$

Sum the $LVCU_{\text{phase}}$ results and apportion 1/3 of the system losses ($LVCU_{\text{avg}}$) to each of the 3 meter elements.

$$LVCU_{\text{avg}} = (4,086,917 + 4,086,917 + 4,086,917) / 3 = 4,086,917$$

Calculate TLC coefficient: (calculated for each of 3 meter elements)

$$K_{VCU} = 4,086,917 / (10 \times 200)^2 = 1.02173 \text{ for each meter element}$$

TLC COEFFICIENT SUMMARY

For each Form 9 meter element A, B, and C:

$$K_{WFE} = 0.00012543$$

$$K_{WCU} = 0.06955$$

$$K_{VFE} = 7.634 \times 10^{-12}$$

$$K_{VCU} = 1.02173$$

JEMSTAR CALCULATION OF LOSS WATTS AND VARS

Equations for each meter element:

$$\text{IRON LOSS WATTS} = K_{WFE} \times V^2$$

$$\text{COPPER LOSS WATTS} = K_{WCU} \times I^2$$

$$\text{IRON LOSS VARS} = K_{VFE} \times V^4$$

$$\text{COPPER LOSS VARS} = K_{VCU} \times I^2$$

Example: If the PT and CT secondaries for each phase are 125 volts and 5 amps respectively.

Scale by PT and CT ratios (done within JEMSTAR)

$$V = 125 \times 66 = 8250 \text{ volts}$$

$$I = 5 \times 200 = 1000 \text{ amps}$$

Calculate losses for each element

$$\text{IRON LOSS WATTS} = 0.00012543 \times 8250^2 = 8537 \text{ watts}$$

$$\text{COPPER LOSS WATTS} = 0.06955 \times 1000^2 = 69,550 \text{ watts}$$

$$\text{IRON LOSS VARS} = 7.634 \times 10^{-12} \times 8250^4 = 35,365 \text{ VARs}$$

$$\text{COPPER LOSS VARS} = 1.02173 \times 1000^2 = 1,021,730 \text{ VARs}$$

NOTES ON BPR (BILLING PERIOD RESET)

CAUTION

Data can be lost if it is not downloaded and saved prior to performing a BPR command.

The BPR function is used to clear the storage registers in a JEMStar meter. This operation can be performed manually from the meter's front panel user interface, or via JEMRead or JEMWare software commands. In addition, the user can program an Automatic Schedule in JEMRead to perform a BPR as a regular occurrence. Make sure that your data has been saved before a BPR is performed.

JEMSTAR ANALOG OUTPUT VERIFICATION

JEMStar can include an optional feature that consists of three analog output channels. All three channels are defined at the time of manufacture for either 0-1 mA or 4-20 mA outputs. Each of the output channels can be configured to represent any instantaneous quantity measured by the meter (watts, VARs, volts, amps, etc.). This procedure uses Volts as the test input because it is the simplest quantity to regulate precisely.

Re-calibration of analog outputs must be done at the factory only. However, the user can verify the accuracy of the outputs by following this procedure. If a problem is found, please contact AMETEK's technical support group.

Test Setup

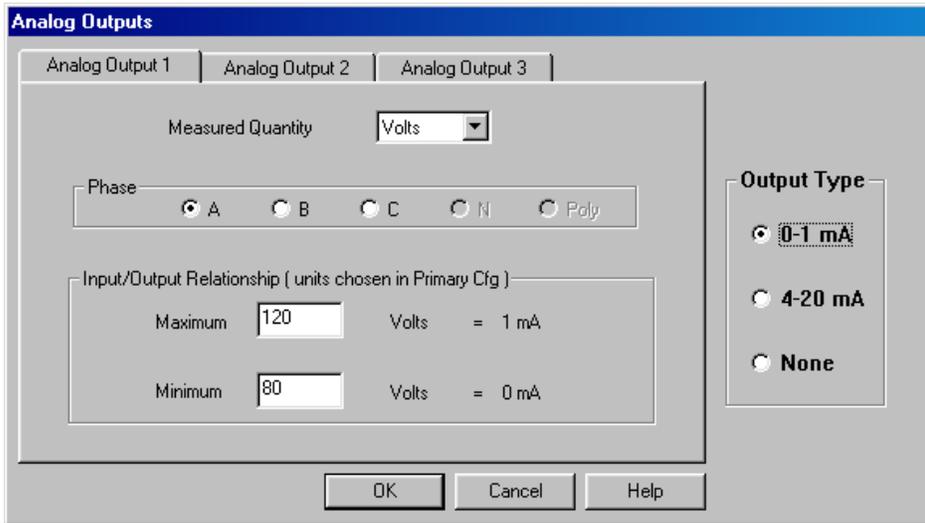
The meter under test should be installed in a test fixture so that the input voltage can be adjusted during the test. In addition, the outer globe must be removed to allow access to the front panel pushbuttons, and the Security keys must be installed (See the Maintenance section of User Manual 1083-600 for this procedure). You will need the following:

- Stable AC voltage source capable of 80 to 120 Vrms at 10VA
- 1K ohm resistor, +/- 0.01% (if testing a meter with 0-1mA outputs)
- 250 ohm resistor, +/- 0.01% (if testing a meter with 4-20mA outputs)

Step 1: Using JEMWare (Meter Settings/Analog Outputs menu), configure all three analog outputs for the following:

Measured Quantity:	Volts
Maximum:	120
Minimum:	80
Phase:	A

Output Type: Click the range that was factory set for your meter



Step 2: In JEMWare (Meter Settings/Display Registers/Add menu), add a Normal display register as follows:

ID:	Any unused register number (25 shown in the example)
Register Category:	Register
Register Type:	Instantaneous
Base Quantity:	Volts
Phase:	Phase A
Storage Type:	Working
Number of Digits:	5
Decimal Position:	2

ADD

ID (range 0 - 99) 25

Register Category Register

Register Type Instantaneous

Base Quantity Volts

Phase Phase A

Direction

TOU

Storage Type Working

Display Format

Number of Digits 5

Decimal Position 2

Example (123456) 123.45

Description (19 characters) Inst.Volt:A, ,.Wk Suggestion

Units of Measurement (from Primary Configuration) Volts

OK Cancel Help

Step 3: Download this configuration to the meter to be tested. Refer to the JEMWare instruction manual 1083-602 for further details about downloading new configurations.

Step 4: Connect a stable AC voltage source to Phase A volts. Refer to the connection diagrams in the JEMStar User Manual 1083-600 for your meter Form. Use a voltage source capable of 80 to 120 volts, with a minimum 10VA. For a switchboard meter, apply power to Aux. Power as well.

Step 5: Connect a load resistor to the meter’s analog outputs. For the S-Base and A-Base meter styles, *JEMStar* analog output connections are provided via a 3-foot multi-conductor cable. The wire colors are as follows.

S- & A-Base Analog Output Connections

Color	Signal
Wht/Red/Brn	Aout 1 -
Wht/Red/Grn	Aout 1 +
Wht/Org/Brn	Aout 2 -
Wht/Org/Grn	Aout 2 +
Wht/Blk	Aout 3 -
Wht/Gry	Aout 3 +

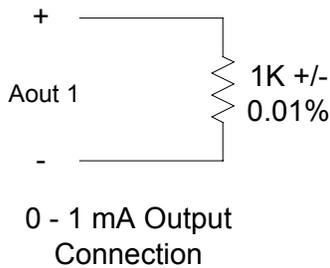
For Switchboard style meters, the connections are provided on rear-mounted terminal blocks.

Switchboard Analog Output Connections

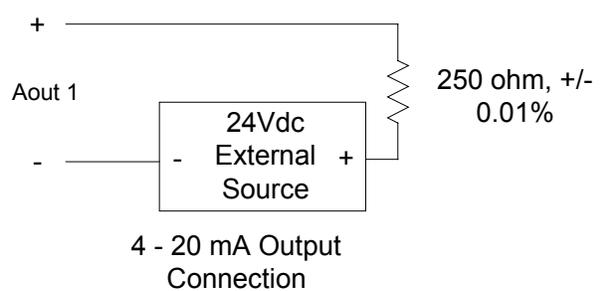
Terminal	Signal
8	Aout 1 -
7	Aout 1 +
6	Aout 2 -
5	Aout 2 +
4	Aout 3 -
3	Aout 3 +

Depending upon your meter’s output range, connect a load resistor to Aout 1 as follows:

0-1 mA Outputs



4-20 mA Outputs



Step 6: Apply 80 volts to the Phase A meter terminals. Repeatedly press the front panel “READ” pushbutton to scroll to the display register you assigned for Phase A volts in Step 2, and then press “SET” to hold the display at this register. Adjust the source voltage to read 80.00 +/- 0.02 volts on the LCD display. Measure the output voltage across the load resistor, and verify that the analog output is as follows:

Range	Reading
0-1mA	0.00 V, +/- 0.001V (+/- 0.1%)
4-20mA	1.00 V, +/- 0.004V (+/- 0.1%)

Step 7: Increase the source voltage to read 120.00 +/- 0.02 volts on the LCD display. Measure the output voltage across the load resistor, and verify that the analog output is as follows:

Range	Reading
0-1mA	1.00 V, +/- 0.001V (+/- 0.1%)
4-20mA	5.00 V, +/- 0.004V (+/- 0.1%)

Repeat Steps 5, 6, and 7 for the other two analog outputs at Aout 2, and Aout 3.

EXTERNAL CONTROL OF LOAD PROFILE RECORDING

JEMStar users have requested a method to distinguish Load Profile data that was collected during externally recognized, asynchronous periods. In other words, users want to be able to tell if energy recorded by the meter was consumed while some externally controlled period, such as a generator shutdown, was in effect.

To date, users have been able to perform this function with register data by using the TOU Rate Override input. The user configures a Watthour register associated with the TOU Rate Override rate, and then applies a signal to the TOU Rate Override contact input when the external condition is present. This is sufficient in some cases, but some users need *Load Profile* data that is segregated in the same way.

The solution is to configure Load Profile channels to record only when the TOU Rate Override input is active. Using the TOU Rate Override input to mark the external condition allows both registers and Load Profile to collect the same data, which can be compared later.

JEMWare can be used to configure any Load Profile channel to record when the TOU Rate Override contact input is ON.

Note: The TOU Rate Override input does not affect interval timing in any way. It will only gate the collection of measurements in configured Load Profile channels.

Load Profile channels configured to record only during TOU Rate Override are not associated with a given TOU rate. For example: If the meter is configured to use Rate C as the TOU Override rate, and Rate C also appears in the normal TOU schedule, the selected Load Profile channels record only while the TOU Rate Override input is on.

Average Instantaneous Load Profile channels that are configured for TOU Rate Override are averaged over the period that the TOU Rate Override input is on. For example, with a constant 1000 watts applied to the meter and an Average Instantaneous Watt load profile channel, if the TOU Rate Override input is active for one half of an interval the final value recorded in that interval will be 1000 watts, not 500 watts. If the TOU Rate Override input stays off for the entire interval, the channel will record 0. (An exception to this is Average Power Factor, which resets to 1.0 at the beginning of an interval and will remain there unless some actual measurements are collected.)

JEMStar can be optionally configured to only record Load Profile data during externally triggered periods. This can be user-selected on a per channel basis, which means that some channels can record constantly, and some can record upon command from an external source. JEMWare can be used to configure any Load Profile channel to record when the TOU Rate Override contact input is ON.

To configure this operation in JEMWare:

1. Go to the Load Profile menu and either Add a new LP channel, or highlight an existing one to Edit.
2. In the setup screen, choose “Records During TOU Override Only”. Choose OK.

3. Go to the Contact Input/Output menu and set one of the two Input channels for “TOU Rate Override”.
4. Apply a signal to the Contact Input to begin LP recording on the designated channel.

Notes:

- The TOU Rate Override input does not affect interval timing in any way. It will only gate the collection of measurements in configured Load Profile channels.
- Load Profile channels configured to record only during TOU Rate Override are not associated with a given TOU rate. For example: If the meter is configured to use Rate C as the TOU Override rate, and Rate C also appears in the normal TOU schedule, the selected Load Profile channels record only while the TOU Rate Override input is on.

TROUBLESHOOTING TIPS

General Meter Usage

The “E” status flag is lit on the LCD display:

This indicates that the microprocessor has experienced a problem during normal functioning. The problem may have been caused by an external operation, or simply during normal processor activity. Once activated, the Error flag will “lock in” and remain on until reset, therefore the anomaly may or may not still exist. Check to ensure that the power supply voltage is within its operating range. To reset the indicator, turn the power off, and then back on again. If the flag lights immediately, the problem still exists, and requires further investigation. If the flag stays out, the problem has cleared itself, and no further attention should be necessary.

The RS-485 serial data output does not work properly:

The serial port on JEMStar can be configured for either RS-232C or RS-485. RS-232C is a straightforward cable connection to a single device. However, in a two-wire RS-485 link, data flow is bi-directional and half-duplex (data is never transmitted and received at the same time). RS-485 lines should be connected in a daisy chain configuration with a 120-ohm termination resistor jumpered in at each end of the chain. Refer to the Maintenance section of the JEMStar User Manual 1083-600 for jumper instructions.

JEMWare Software

Error Message: Could not connect to meter

Select "Connect..." from the Meter Communication menu. Click on the COM port you are using, and make sure the baud rate is set the same as the JEMStar meter. If not, click the Setup button, and verify your connection type, baud rate, and address is correct. Click OK to return to the first screen, and then select the Connect button. If you get another error message, then you did not select an open port on your system. Try to select different ports until you find one that works. If you are still unable to establish communications, contact AMETEK for assistance.

Error Message: "Could not send command. Process aborted."

If this message appears when you attempt to Write or Read configuration data, check to see if you are connected to the correct COM port on your computer.

The meter is not responding:

Make sure that the JEMStar is connected to the selected serial port. Check your cable connections and make sure the meter is powered by checking the LCD display on the front plate. Contact AMETEK for assistance.

Other errors during communications:

Most error messages result from unexpected problems during communications. Usually these problems are transient and retrying communications will work. If communication errors become frequent, the cable you are using may be defective.

JEMRead Software

Error Message: Could not connect to meter

Select "Connect..." from the Meter Communication menu. Click on the COM port you are using, and make sure the baud rate is set the same as the JEMStar meter. If not, click the Setup button, and verify your connection type, baud rate, and address is correct. Click OK to return to the first screen, and then select the Connect button. If you get another error message, then you did not select an open port on your system. Try to select different ports until you find one that works. If you are still unable to establish communications, contact AMETEK for assistance.

The meter is not responding:

Make sure that the JEMStar is connected to the selected serial port. Check your cable connections and make sure the meter is powered by checking the LCD display on the front plate. Contact AMETEK for assistance.

Other errors during communications:

Most error messages result from unexpected problems during communications. Usually these problems are transient and retrying communications will work. If communication errors become frequent, the cable you are using may be defective.

My RS-485 network does not recognize all the meters in the string:

Each JEMStar in the string must have a unique address assigned using *JEMRead* software. You will need to configure the addresses individually before you connect the RS-485 network cabling. Refer to the *JemRead* instruction manual 1083-601 for full details.