

# Welding Equipment Meter Calibration

Articles from the *TechLine*  
Service Newsletter



Miller Electric Mfg. Co.  
Appleton, WI  
[www.MillerWelds.com](http://www.MillerWelds.com)



## Preface

The information in this booklet began as articles in the Miller Electric *TechLine* newsletter, in 2000. A large number of follow-up requests led to the preparation of this booklet. We hope that these articles will help you understand what is needed to successfully provide a calibration/certification service.

Keep in mind that these articles give examples for instructional information only. This document contains information about factory calibration procedures using certified calibration instruments, and we are not responsible for usage outside Miller Electric Mfg. Co. If after reading this material you still have questions on specific Miller machines, please call 920-735-4505 during business hours. The calibration forms and certificates used are not supplied by Miller Electric - you will need to purchase or create your own forms that are customized for you.

As always, when working on welding equipment, follow all safety precautions in the Owner's and Technical Manuals. Have only qualified service technicians calibrate welding equipment.

Thank you,

Miller Electric Mfg. Co.



# TechLine™

## What You Need to Know about Meter Calibration

by Stan Hischke, Product Testing Calibration Technician



Stan Hischke

In this issue and the next issue, we'd like to discuss the various aspects of meeting customer's needs concerning meter calibration. Have you received questions from your customers concerning ISO 9000, and the accuracy of the customer's meters? It's possible you may be asked just to

calibrate meters so that the customer knows their meters are accurate. Or, your customer may be concerned with ISO 9000 certification.

The purpose of ISO 9000 standards is to ensure that customers purchase products that are designed, built, tested, and sold under controlled conditions by trained people. Any customer, whether they represent a small company or a large multinational company, minimizes their purchasing risk by dealing with internationally recognized, ISO 9000 registered suppliers.

ISO 9000 audits are concerned with the documentation that businesses have, and whether they are following that documentation in their work procedures. It's up to the business to be responsible for the step-by-step procedures of their documentation.

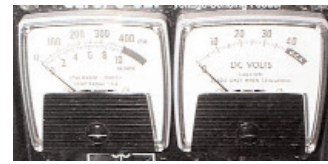
Providing meter calibration services can be easier than you think, and the goal of these articles is to help you provide this service to your customers. We'll begin by laying some of the groundwork to help understand what we are trying to accomplish

with meter calibration. Four topics will be covered at this time:

1. Calibration vs. Certification
2. How often is calibration necessary?
3. Resistive load vs. a welding arc
4. Calibration Equipment Source



Digital Meters



Analog Meters

### Calibration vs. Certification

When you calibrate a meter, you are simply verifying that the meter is accurate within tolerances, and if not, you adjust it to make it accurate. Certifying the meter means supplying a "paper trail" showing that the calibrated meter can now be traced back to the National Institute of Standards and Technology (NIST), through your testing equipment. This simply means that you need a source to certify your meter also.

### How often is calibration necessary?

When do you calibrate the customer's machine meters? We recommend every year, hopefully combined with a preventive maintenance package. Remember that for the procedures for ISO 9000, you can make this interval any time period you want. The actual procedures made for ISO 9000 documentation can come from a couple of sources: the customer could give you the procedure, they may ask you to provide a procedure, or you may work on the procedure together with the customer.

*Continued*

## What You Need to Know about Meter Calibration

Continued from Page 1.

In an article to follow, we will provide a sample procedure form that can be used as a guideline. The "bottom line" with a procedure is - make sure you do what you say you are doing in the procedure. (If you say you are going to test the meters every two years, make sure you have a system in place to remind you when two years are up.)

Also keep in mind that the time interval you and your customer develop can be changed. For example, if you find that the meters are staying accurate and don't need to be adjusted year after year, there is nothing wrong with extending the meter calibration interval to every two years. And the opposite is also true, that if the meters are needing calibration more often, you can change the interval to every six months.

### Resistive load vs. a welding arc

A welding arc is often referred to as a dynamic load, which simply means it is a changing load. Therefore, **do not calibrate meters while welding.** We strongly recommend using a resistive (constant) load. Both Miller Load Banks are excellent examples of resistive loads. The LBP-350 Portable Load Bank was specifically designed to help you calibrate meters in the field. (It weighs only 46 pounds.)



Miller Load Bank  
#902 804



LBP-350 Portable Load Bank  
#043 329

## Calibration Equipment Source

Some of you may already have a company that you purchase your calibration equipment from, and that's fine. If you do not have such a company, we'd like to introduce you to **Transcat**, a company that we are very familiar with. Transcat calibrates and services all brands of calibration, test, and measurement instruments. They are headquartered in Rochester, New York, and have many locations across the nation. They can be reached at:

Phone: 800-828-1470, or 716-352-9460

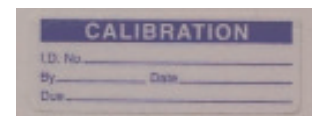
FAX: 800-395-0543, or 716-352-1486

Website: [www.transcat.com](http://www.transcat.com)

E-mail: [info@transcat.com](mailto:info@transcat.com)

Transcat not only sells test equipment, but will also supply you with the "paper trail" you need for your testing equipment certification. Transcat can also calibrate your previously owned test equipment.

We also can recommend a source, **Q-Cee's Products Division**, that can supply you with the actual stickers you apply to the meters. These stickers will have places for you to fill in the information needed, such as the date calibrated, due date for the next calibration, and the calibrating person's identification. Q-Cee's is located in Houston, Texas, and can be contacted by phone at 800-950-4922, or 707-575-3524.



Sample Stickers from Q-Cee

**Editor's Note:** Hopefully this first article raised your interest in calibrating and certifying welding equipment. In the next issue of TechLine, we will go into more detail on calibration test equipment, and we will provide information on a sample calibration procedure. If you have questions on the information provided here so far, or something else you'd like to see in TechLine, please don't hesitate to drop us a fax at **TechLine**, 920-735-4013. We appreciate your input!



# TechLine™

July, 2000

## What You Need to Know about Meter Calibration (Part 2)

by Stan Hischke, Product Testing Calibration Technician



Stan Hischke

*Warning: When working on welding equipment, follow all safety precautions in the Owner's and Technical Manuals. Have only qualified service technicians calibrate welding equipment.*

In this follow-up article on meter calibration and certification, we want to show you a sample procedure you might follow. Please locate the insert page and keep it handy, as we'll be referring to it.

Let's say for example that your customer has asked you to calibrate/certify their Miller CP-302 welding power source. You have also been

provided with a procedure written by their Quality Assurance department. (See #1 on insert.) At this time, read Steps A & B. We have filled out a sample sheet for Step B - Ammeter. To calculate the percentage of error, follow this example from the Calibration Data Sheet (#2 on insert):

$$300 - 289.7 = 10.3$$
$$10.3 \div 300 = .034333 = 3.4\%$$

In Step "C" fill out the Certificate of Calibration (see #3 on insert). Add a sticker to the CP-302, fill out the paperwork, and you're done!

We'll cover more on calibration in future TechLines, but we'd like your input as to what issues about calibration concern you. Why not drop us a line on our fax machine? Contact us at: FAX 920-735-4013. Let us know what you think about this calibration information so far, and what else we can cover that would be of value to you. Thanks!



CP-302 Power Source

Example  
#1

Date: 3-10-99

## WELD UNIT METER CERTIFICATION PROCEDURE

### A. Voltmeter Certification

1. Voltage readings shall be taken at the output studs of unit under test. Voltage readings shall be taken at open circuit voltage with the Fluke 45.
2. Verify that welder voltmeter reading is within + or - 10% of standard meter reading. (If adjustment is required, see technical manual for each make and model.)
3. Take readings at 10 volt intervals from min to max open circuit voltage.
4. Record data on a Calibration Data Sheet (Form #686-8/99).

### B. Ammeter Certification

1. Put certified shunt in series with Miller Load Bank #043329 and the output of unit under test.
2. Monitor output of shunt with Fluke 45.
3. Verify that welder ammeter reading is within + or - 10% of standard meter reading. (If adjustment is required, see technical manual for each make and model.)
4. Take readings at 100 amp intervals from 100 amps to max amperage output of unit under test.
5. Record data on a Certification Calibration Data Sheet (Form #686-8/99).

### C. Certificate

1. Fill out Certificate of Calibration form #189-3/99.
2. Fill out a Certification sticker. Place sticker on front panel of unit under test.
3. Customer receives the original Certificate of Calibration.
4. File a copy of the Certificate, along with a copy of the order inquiry, and all of the completed data sheets.

Example  
#2

## Form #686-8/99 CALIBRATION DATA SHEET

Make: Miller Model: CP-302

Serial Number: HH0123456

**METER:** Current X (AC \_\_\_\_\_ DC X)  
or Voltage \_\_\_\_\_

**RANGE:** Low \_\_\_\_\_ High \_\_\_\_\_ Not Applicable (N/A) X

SCALE		Primary Standard	WELDING MACHINE METER	
Settings	%Error	Measurement	Measurement	%Error
N/A	N/A	289.7	300	-3.4
N/A	N/A	194.4	200	-2.8
N/A	N/A	101.6	100	+1.6

Signed: Joe Technician Date: 5-2-2000

Example

#3

Form #189-3/99

# Certificate Of Calibration

Miller Model No. CP-302

Miller Part No. 654321

Serial No. HH0123456

P.O. No. MW636

Certificate No. 1

*(Your company Name Here) does hereby certify the above instrument was calibrated against standards maintained by (Your company Name Here) and meets or exceeds specifications. The accuracy of these standards is directly traceable to the National Institute of Standards and Technology.*

Calibration Date: 2/10/2000

Temperature: 72°F

Humidity: 49% R.H.

Certified By: Joe Technician

Recommended

Recalibration Date: 2/10/2001

Applicable N.I.S.T. standards & dates

Fluke 45

S/N 000000 Cal. 10/1/99

T & M Shunt

S/N 00000 Cal. 10/1/99

Your Company Logo Here

# Calibration Questions and Answers

By Stan Hischke, Product Testing Calibration Technician

In the last two issues of TechLine, we have presented information on the subject of meter calibration. We've received some excellent feedback, and we'd like to answer a few of your questions in this issue. In our next issue, we will address the subject of meter calibration of wire feeders.

**Q: *Can I use a calibrated clamp-on meter to calibrate an ammeter, instead of a shunt?***

A: We do not recommend it. The readings on a clamp-on ammeter can be changed by changing the position of the cable in the jaws of the clamp-on ammeter. A clamp-on is not accurate enough, and the readings are not repeatable. We recommend that you purchase a precision shunt. If you are using a Miller Load Bank, the Load Bank can be used as your primary standard for ammeter calibration.

**Q: *Do you have a good source for where I can purchase calibrated precision shunts?***

A: Yes, you can contact Empro Manufacturing of Indianapolis, Indiana, at Phone 317-823-4478, or FAX 317-823-4835. Empro's model 5091-600-600 is a 600 amp, 600 millivolt shunt. Every amp of current will output a 1 millivolt signal. This makes it very easy to read the output, ie, 100 amps is read as 100 millivolts on your calibrated multimeter.

You can purchase a 5091-600-600 for \$119.26. Empro will calibrate this shunt to .1% accuracy, and furnish you with an NIST certificate for \$8.00. They will engineer special shunts for any application. (*Prices subject to change at some future date.*)

**Q: *Can I use a Load Bank to calibrate my welder's voltmeter?***

A: No. Amperage is a series connection, and can be measured at any point in the circuit. Voltage is not a series connection, and under a load, cable losses can be significant. The only way to verify voltage is to take a reading at the output studs with your calibrated multimeter.

**Q: *I have a Miller Load Bank. Can I take the ammeter out and send it somewhere for calibration?***

**Q: *Can I take the meters out of welders and send them somewhere for calibration?***

A: No. Keep in mind that the meter is only as accurate as the signal being fed it. All the wiring, shunt, P.C. board, etc., in the load bank or welder can affect readings so you are really calibrating the whole unit and not just the meter. You have to calibrate the Load Bank or welder as a unit.

**Q: *I have been asked about older welders that don't have meters - how can I calibrate them?***

A: We do not recommend calibrating machines that don't have meters. Suggest to your customers that they add meters if possible, or upgrade to machines with meters if they are in need of calibration standards.

Keep those good questions coming! You can fax your question to *TechLine*, at 920-751-4013.





# TechLine™

April, 2001

## What you Need to Know about Meter Calibration (Part 3) Or

### How I Learned to Stop Worrying and Love the IPM Meter

By Stan Hischke, Product Testing Calibration Technician

I'll bet many of you have checked wire feed speed by the old method of feeding out wire for six seconds and multiplying that length by ten. I know I have, and it does give a ballpark figure that can be useful. This method however, would not be recommended for calibrating/certifying an inch per minute (IPM) meter.

Instead, get yourself a good hand-held digital tachometer. Transcat is a good source for test equipment, offering many makes and models of tachometers. Personally, I've had good experience with tachometers made by Extech. Transcat can also certify your test equipment (supply the paper trail back to the National Institute of Standards and Technology). They will also take care of your record keeping online on their website. If interested, just check out their website. Transcat can be reached at:

Phone: 800-828-1470, or 716-352-9460

FAX: 800-395-0543, or 716-352-1486

Website: [www.transcat.com](http://www.transcat.com)

E-mail: [info@transcat.com](mailto:info@transcat.com)

Follow the Wire Feed Meter Certification Procedure that is supplied by you or your customer (see example #1 on insert). Notice in step 4 of this procedure, that the RPM reading from your tachometer is multiplied by 5.128. This is the nominal circumference of a Miller 60 Series feeder drive roll. If the drive roll is a different size, you will need to measure its circumference or call the manufacturer to get the correct value.

To calculate the percentage of error, follow this example from the Calibration Data Sheet (example #2 on insert).

700 IPM (displayed on the Wire Feed Meter) minus 692.3 IPM (the actual IPM that you just measured) equals 7.7 IPM difference. Divide this by the original 700 IPM to get the percentage of error (1.1%).

$$700 - 692.3 = 7.7$$

$$7.7 \div 700 = 0.011 = 1.1\%$$

The next step in this Certification Procedure is to fill out the Certificate of Calibration (see example #3 on insert). Then add a sticker to the Wire Feeder, make yourself a copy, and you're done!



To measure inches per minute, the technician is holding a digital tachometer to the center of a drive roll on the Miller 60 Series wire feeder.

Example

#1

Date: 4-1-00

### WIRE FEED METER CERTIFICATION PROCEDURE

#### A. Inch Per Minute (IPM) Meter Certification

1. Disengage drive rolls so wire will not feed. Actuate the drive rolls by pressing the "jog" switch.
2. Use a digital tachometer to determine the RPM of the drive roll.
3. Take readings at 200 IPM intervals from 700 to 100 IPM.
4. Multiply the RPM by the nominal circumference of the drive roll (5.128) to determine Inches Per Minute.
5. Verify that the IPM Meter is within +/- 5% of the primary standard meter reading. If adjustment is required, see the Technical Manual.
6. Record data on a Calibration Data Sheet (Form #002-8/99)

#### B. Certificate

1. Fill out Certificate of Calibration form #189-3/99.
2. Fill out a Certification sticker. Place sticker on front panel of unit under test.
3. Customer receives the original Certificate of Calibration.
4. File a copy of the Certificate, along with a copy of the order inquiry, and all of the completed data sheets.

Example

#2

### Form #002-8/99 CALIBRATION DATA SHEET

Make: Miller Model: S-62 Feeder

Serial Number: HJ234567

**METER:** Current \_\_\_\_\_ (AC \_\_\_\_\_ DC \_\_\_\_\_ )  
 Voltage \_\_\_\_\_ (AC \_\_\_\_\_ DC \_\_\_\_\_ )  
 IPM X \_\_\_\_\_

Primary Standard			Wire Feed Meter (under test)	
RPM Measurement	Multiplier*	IPM	IPM	% Error
135	5.128	692.3	700	1.1
96	5.128	492.3	500	1.5
58	5.128	297.4	300	0.9
19	5.128	97.4	100	2.6

\*Nominal circumference of drive roll.

Signed: Joe Technician Date: 1-12-2001

Example

#3

Form #189-3/99

# Certificate Of Calibration

Miller Model No. S-62 Feeder

Miller Part No. 765432

Serial No. HJ234567

P.O. No. MW636

Certificate No. 1

*(Your company Name Here) does hereby certify the above instrument was calibrated against standards maintained by (Your company Name Here) and meets or exceeds specifications. The accuracy of these standards is directly traceable to the National Institute of Standards and Technology.*

Calibration Date: 1/12/2001

Temperature: 72°F

Humidity: 49% R.H.

Certified By: Joe Technician

Recommended \_\_\_\_\_

Recalibration Date: 1/12/2002

Applicable N.I.S.T. standards & dates

Extech Contact/Photo Tachometer

S/N 000000 Cal. 10/1/00

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Your Company Logo Here



2/02  
323-0162  
195097  
Cost: \$3.00