

# WM-1

Digital Temperature  
Measurement System

User Manual



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## Foreword

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Thank you for purchasing the SYSCON Sensors WM-1 Digital Temperature Measurement System. This User's Manual contains useful information about the functions, installation, wiring, operating procedures, safety, and troubleshooting of the WM-1. The user should carefully read and understand the contents of this manual prior to the use of this equipment. Using the instrument in manner not specified in this User Manual can damage the instrument.



Keep this manual in a safe place for quick reference in the event a question arises.


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# Before You Start


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<b>NOTE</b>	Contains important information for proper operation of the instrument
	Identifies conditions that may cause damage to the instrument or large errors in measurement
	Identifies conditions which may cause damage to the user. To avoid injury or death of personnel, the operator must refer to the explanation in the User Manual
Software Version	1-01

** NOTE**



This product contains electronic boards and components which may be damaged by electrostatic discharge (ESD). When handling, care must be taken so that the devices are not damaged. Damage due to inappropriate handling is not covered by the warranty.

** NOTE**

**If the WM-1 Digital Temperature Measurement System is opened by people unauthorized by SYSCON Sensors, the Warranty is null and void.**

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## Introduction

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The SYSCON Sensors WM-1 Digital Temperature Measurement System is a portable, reliable, and rugged temperature display for molten metal temperature measurement in foundries and steel mills. The WM-1 is designed for use with lance attachments and comes with light and sound alarms to indicate the end of the measuring cycle. The unit can be programmed to display the measured temperature in °F or °C.

The WM-1 Digital Temperature Measurement System has the following features:

- Quick and accurate temperature measurement from 400°F – 3300°F with an instrument accuracy of  $\pm 3^\circ\text{F}$  ( $\pm 2^\circ\text{C}$ )
- Designed for use with types S, R, B, or K thermocouples for IPTS-48, IPTS-68, and ITS-90 calibration standards.
- Large 2.3" (58 mm) easy-to-read digital display
- Rugged dust proof NEMA box ideal for foundry and steel mill environment.
- Designed to generate accurate readings in high electrical noise environments common in foundry and steel mills.

## Specifications

Measurement Input	Single Thermocouple Input (S / R / B / K)
Temperature evaluation method	Flat plateau detection
Operating Temperature	0°F -122°F (-17°C -50°C)
Storage Temperature	0°F -167°F (-17°C -75°C)
Input Power	100 - 240 V 60 Hz AC Input
Power Consumption	12 W
Weight	2.4 lb (1.1 kg)
Dimensions	10" W x 5.75" H x 2.375" D (25.4 cm x 14.6 cm x 6 cm)
Ambient Humidity	0 to 90% non-condensing



## Application

The WM-1 Digital Temperature Measurement System is used to measure molten metal temperatures for an immersion/batch or continuous mode of operation. The thermocouple type is determined by the temperature range of the molten metal and the desired accuracy. The color codes and operating temperature limits (ANSI 96.1 Standard) for types S, R, B and K are listed in **Table 1**. The temperature limits are for the thermocouple wire diameter of 24-gauge wire for type S, R, and B and 8-gauge for type K. Temperatures above the recommended temperature cause the thermocouple wires to melt, resulting in an open circuit causing the WM-1 Digital Temperature Measurement System to display an error message.

**Table 1:** Thermocouple comparison (types S, R, B, and K)<sup>1</sup>

Thermocouple Type	Common Name	Alloy Type	Plug and Jack color	Wire Color	Maximum Temp. °F (°C)	Recommended Operating Temp. °F (°C)
		Positive end		Negative end		
S	10%	Platinum Rhodium – 10%	Green	Black	3214 (1600)	2640 (1450)
		Platinum		Red		
R	13%	Platinum Rhodium – 13%	Green	Black	2912 (1600)	2640 (1450)
		Platinum		Red		
B	6 / 30 %	Platinum Rhodium – 30%	White	Gray	3272 (1800)	3100 (1700)
		Platinum Rhodium – 6%		Red		
K	Chromel - Alumel	Nickel - Chromium	Yellow	Yellow	2460 (1350)	2300 (1260)

<sup>1</sup> Preston-Thomas, H. "The International Temperature Scale of 1990 (ITS-90).", Metrologia, Vol 27, 1990, pp: 3-10

## Setup

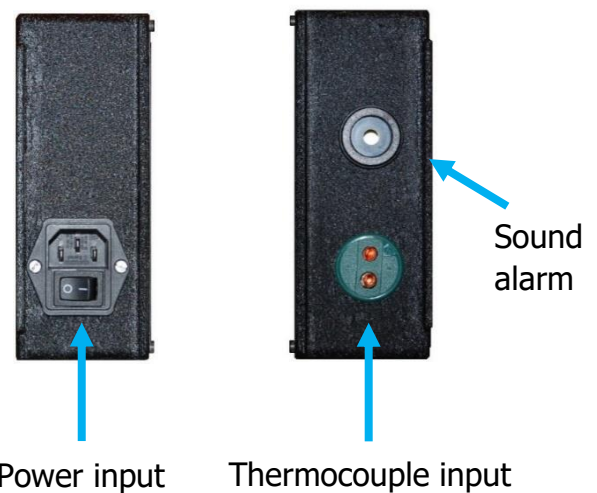
This chapter discusses the setup procedure of the WM-1 Digital Temperature Measurement System. The front and side views of the WM-1 highlighting the input connections and mounting locations are discussed. General guidelines for electrical connections to the WM-1 are presented. The setup procedure is simple with only the input power and thermocouple connections required. The front panel consists of the digital display and a unique serial number sticker as shown in **Figure 1**.

### Electrical and Thermocouple Wiring



Indicator LEDs

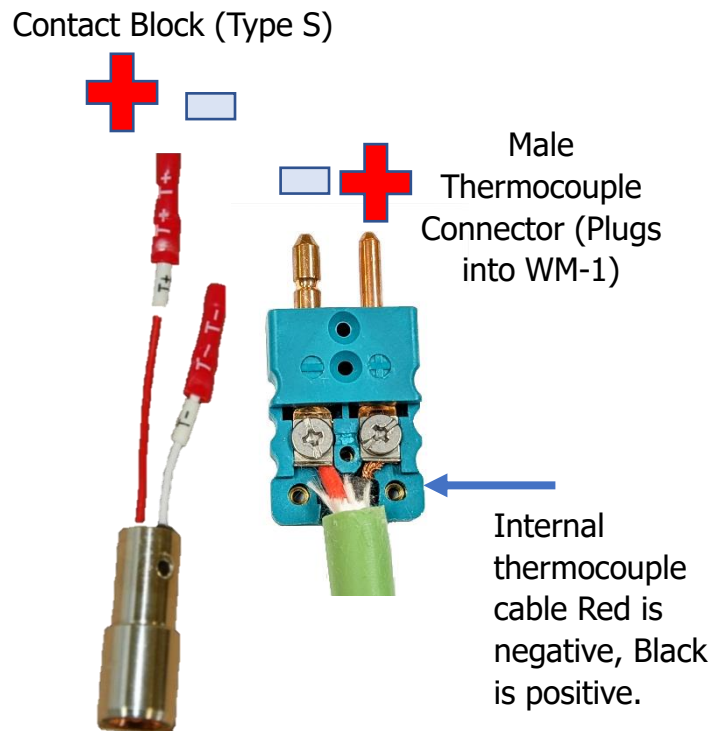
**Figure 1:** WM-1 Front panel



**Figure 2:** Side views of WM-1 (a) Left side: AC power input panel (b) Right side: Thermocouple input jack (Type S shown) and Sound alarm.

The left and right-hand side views are shown in **Error! Reference source not found..** The WM-1 is designed to be used on 100 - 240 V AC input power source of 60 Hz frequency (see **Error! Reference source not found. Left**). The power supply unit is a switching regulator type that produces the required internal voltages from almost any standard power source. Quick disconnect connectors, shown in **Error! Reference source not found. Right** are used to connect thermocouple inputs. The thermocouple input plug should match the type of thermocouple input panel otherwise, large errors (about 100°F) may occur.

When Type S or R thermocouples are used, compensated lead wires must be used throughout. Serious errors will result when non-compensated lead wires (copper/copper) are used with these thermocouples. For proper operation, it is essential that the proper polarity is maintained throughout the internal and extension wiring as shown in **Figure 3**. Incorrect polarity results in additional thermocouple junctions which leads to incorrect readings.



**Figure 3:** Polarity of contact block and thermocouple connectors (type S shown) wires

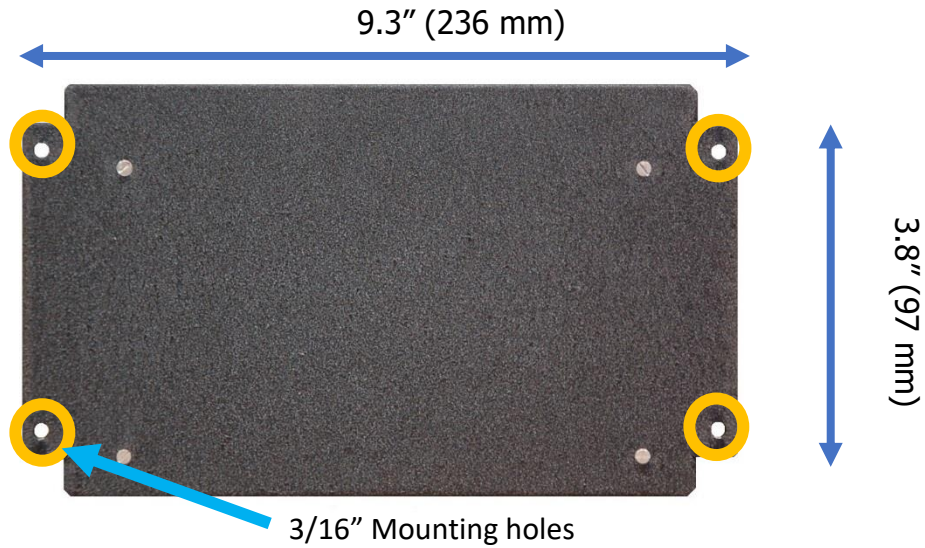


**NOTE**

Proper grounding is required for reliable operation. For line power and/or plug-in installations, the electrical outlet should be checked for proper wiring with a plug-in receptacle circuit tester. The ground terminal must be connected to an adequate ground ( $< 2 \Omega$  between the instrument ground and power ground).

## Mounting Guidelines

The WM-1 has four 3/16" mounting holes to mount it to a strong secure foundation as shown in **Figure 4**. It can be mounted to a wall, column or metal plate depending on the application.



**Figure 4:** Mounting points on the back panel

**NOTE**

Mounting accessories are not provided with the WM-1.

## Quick Start

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### Operating Controls and Indicator

The **power ON/OFF switch** controls all power into the WM-1. The **digital display** displays measurement results, error messages, and measurement settings. In addition to the four large LEDs to display temperature, a fifth one-inch display indicates whether the temperature displayed is in °C or °F as shown in **Figure 1**. The front panel has three large lights to show status of a measurement run and/or operating mode. A side panel **Sonalert** produces a clear audible tone in conjunction with the **RED Complete** light to signal the end of the temperature measurement.

**Table 2: Measurement Status LED's**

LED Color	Status	Measurement Status
Green	<b>READY</b>	Thermocouple tip (sensor) makes electrical contact with the contact block and ready for measurement
Yellow	<b>MEASURE</b>	Temperature measurement in progress
Red	<b>COMPLETE</b>	Measurement complete. Remove thermocouple or take a new measurement

## Quick Start Procedure

1. Plug the AC power supply to the WM-1 and wait approximately 50 seconds for the unit to boot up completely. The WM-1 cycles through the setup parameters. Once this is complete, the digital display shows the **RED Complete** light as shown in **Figure 1**.
2. Plug the correct thermocouple plug from the lance to the female thermocouple jack in the WM-1. If the thermocouple is in place, the **RED Complete** light switches to **GREEN Ready** light. This indicates that the WM-1 is ready for a new temperature measurement.
3. When the thermocouple is immersed into the molten metal bath, the WM-1 starts the measuring cycle. The **GREEN Ready** light switches to **YELLOW Measure** light on the front panel and the LED display shows 4 dashes (see **Figure 5**).
4. A temperature reading is displayed once the voltage signals from the thermocouple stabilize. The **YELLOW Measure** light switches to **RED Complete** light and the **Sonalert alarm** sounds for 2 seconds.
5. If a stable voltage signal from the thermocouple is not found or if the thermocouple wire breaks, a **9001, 9002 or 9999 error message** reading is displayed.
6. After completion, shut down the WM-1 by flipping the power switch to OFF.

 **NOTE**

DO NOT unplug the power cord with the power switch ON.  
Flip the power switch to OFF before unplugging the power cord.

**NOTE**

Ensure that the thermocouple input type and calibration standard of the WM-1 matches that of the thermocouple tip used for temperature measurement. Refer to the **Startup Sequence** and/or **Calibration Certificate** for verifying the thermocouple input type and calibration standard of the WM-1.



**Figure 5:** On-going temperature measurement indicated by Yellow (Measure) light and four dashes on the display

## Lance/Immersion Probe temperature measurement guidelines

The proper immersion of the expendable thermocouple sensor into the molten metal can have a significant effect on the quality and reliability of the measurement. To get an accurate and reliable reading, SYSCON Sensors recommends the following procedure:

1. Immerse the probe quickly into the molten metal, penetrating the slag as quickly as possible. DO NOT smash the tip of the probe on to hard slag as the probe might break.
2. When taking repeated measurements, allow the lance to cool between measurements. Contact block temperatures greater than 300°F (149°C) can cause erratic measurements.
3. Take measurements with gas stirring and oxygen blowing turned OFF. Wait at least 45 seconds after gas stirring to take a measurement.

4. Turn electrical power to the furnace OFF before taking a measurement. Electrical interference from the electrical field can cause erratic measurements. If the furnace grounding system is broken or corroded, electrical shock can result from taking temperatures when the furnace power is ON.
5. Stir for at least 3-5 minutes after alloy addition before taking a temperature measurement. Alloy additions affect temperature measurement if the probe is inserted in the alloy. Allow sufficient time for the alloy and the metal to be well-mixed before taking a measurement.

**NOTE**

**DO NOT use the expendable thermocouple sensors if they have been exposed to moisture and are wet. Excessive moisture will cause erratic measurements and can result in injury from violent metal splashing.**

Always wear recommended Personal Protection Equipment.



## Startup Sequence

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The WM-1 Digital Temperature Measurement System operating settings are displayed during the power up. Each parameter is shown for about 5 seconds. The entire process takes about 50 seconds. The instrument enters a plateau detection run mode. The display is a seven segment 2.3" LED. The **Appendix** contains the hexadecimal display representations of how messages are formed in the 7-segment display. The default startup parameters during power ON display cycle are shown below in **Table 3**. A brief explanation of each parameter is provided with the default setting italicized.




### **NOTE**




These settings are default and found suitable for most applications. Attempts to change these settings by personnel unauthorized by Syscon Sensors will void the Warranty.


**Contact** SYSCON Sensors to change or determine the right settings for your application.

**Table 3:** WM-1 startup settings

Startup Sequence	Parameter displayed	Details
	1 - 01	<b>Software version number</b>

Startup Sequence	Parameter displayed	Details
 <p>The image shows the WM-1 Digital Pyrometer with a red LED display showing '568F'. Below the display are three indicator lights labeled 'READY', 'MEASURE', and 'COMPLETE'. The device is labeled 'WM-1 DIGITAL PYROMETER' and 'SYSCON SENSORS'.</p>	S68F	<p><b>Thermocouple Input Settings</b></p> <p>Denotes thermocouple input type, calibration standard, and unit of temperature measurement.</p> <p><i>Thermocouple Input Type – S</i></p> <p><i>IPTS Calibration Standard – 68</i></p> <p><i>Temperature measurement unit - °F</i></p>
 <p>The image shows the WM-1 Digital Pyrometer with a red LED display showing 'r 15'. Below the display are three indicator lights labeled 'READY', 'MEASURE', and 'COMPLETE'. The device is labeled 'WM-1 DIGITAL PYROMETER' and 'SYSCON SENSORS'.</p>	r 15	<p><b>Maximum Runtime I</b></p> <p>Maximum runtime denotes the time interval (in seconds) during which the WM-1 attempts to measure the temperature.</p> <p><i>Maximum Runtime – 15 seconds (default)</i></p>
 <p>The image shows the WM-1 Digital Pyrometer with a red LED display showing 'PS C'. Below the display are three indicator lights labeled 'READY', 'MEASURE', and 'COMPLETE'. The device is labeled 'WM-1 DIGITAL PYROMETER' and 'SYSCON SENSORS'.</p>	PS C	<p><b>Measurement Settings</b></p> <p>Determines the Parameter group settings - noise and slope limits for temperature measurement.</p> <p>Three options available</p> <p><i>PS A – tight → Shortest measurement time</i></p> <p><i>PS B – moderate → Intermediate</i></p> <p><i>PS C – wide (default) → Longest measurement time</i></p>

Startup Sequence	Parameter displayed	Details
	I 10	<p><b>Duration of measured temperature display before switching to elapsed time display</b></p> <p>Denotes time (in seconds) to display measured temperature before switching to elapsed time.</p> <p><i>Override if Elapsed time set to 0 (default)</i></p> <p><i>Measured temperature displayed for 10, after which the display switches to the time elapsed from last measurement</i></p>
	d 10	<p><b>Duration of measured temperature display before switching to alternating display</b></p> <p>Denotes time (in seconds) to display measured temperature before switching to alternating display of temperature and elapsed time.</p> <p><i>Measured temperature displayed for 10, after which the display alternates between elapsed time from the last measurement and measured temperature</i></p>
	E 0	<p><b>Duration of elapsed time display</b></p> <p>Denotes time (in seconds) to display the elapsed time from the last measured temperature.</p> <p><i>Elapsed time is set to 0 and is not displayed</i></p>

Startup Sequence	Parameter displayed	Details
	dn - t	<p><b>Time format for elapsed time display</b></p> <p><i>dn - t: MMM:T (default)</i></p> <p><i>dn - s: MM:SS</i></p> <p><i>M → minutes S → Seconds</i></p> <p><i>T → Tenths of a minute</i></p>

## Technical Circuit Information

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The WM-1 Digital Temperature Measurement System electronics consist of circuit boards with the following major components plus miscellaneous support components:

- **Universal Power Supply**

The WM-1 Digital Temperature Measurement System power supply is a switching type power supply which takes 100 – 240 V 60 Hz AC power input and produces a 12 V output.

- **Analog to Digital (A/D) Converter**

The WM-1 Digital Temperature Measurement System receives its signal from the thermocouple through compensated lead wires for type S, R, K inputs or through non-compensated lead wires for Type B input. This signal is amplified by a high-quality input amplifier with filtering to protect against the 60 Hz noise.

- **Auto Zero**

In the normal or run mode, the WM-1 Digital Temperature Measurement System microcontroller uses an auto zero circuit to check for any drift in the system and then looks at the input to measure the voltage signal. The A/D converter subtracts out any drift before proceeding with the temperature measurement reading.

- **Precision Voltage Reference**

The WM-1 Digital Temperature Measurement System uses a precision voltage reference to serve as the basis for all analog to digital conversions.

- **Cold Junction Compensation**

The WM-1 Digital Temperature Measurement System uses a special temperature measuring semiconductor mounted between the lugs of the input terminals to which the thermocouple extension lead wire is attached. This sensor measures the cold end temperature. When the voltages representing the cold end temperature and the sensor temperature are added, the result is a temperature number referenced to 32°F or 0°C (ice point).

- **Linearization**

Since type S, R, B and K thermocouples have nonlinear outputs (millivolts vs. temperature), the digital temperature is corrected to obtain an accurate temperature

reading. The WM-1 Digital Temperature Measurement System microcontroller takes the digital number from the A/D converter and uses a digital linearization algorithm to change the non-linear temperature number to the correct temperature reading before the information is sent to the display.

- **Fahrenheit and Centigrade**

The WM-1 Digital Temperature Measurement System internal measurements and linearization are done in °F because of its higher resolution. If a degree Centigrade display is desired, the microcontroller converts °F to °C using the following formula before sending the information to the display.

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$$

- **LED Display Driver**

The WM-1 Digital Temperature Measurement System LED display driver accepts display information from the microcontroller and supplies a constant current to selected segments of the LED display to display the information.

- **LED Display**

The 7 segment LED display on the WM-1 Digital Temperature Measurement System uses four 2.3" high LED digits. The display reads temperature in °F or °C with a 1° resolution. A smaller 1" LED indicates whether the display is in °F or °C.

## Maintenance

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The internal electronics of the WM-1 require no maintenance. The most frequent cause of operating problems is the need for maintenance of the thermocouple hardware used with the WM-1 Digital Temperature Measurement System. Often contact blocks or the compensated measurement cable inside the lance and measurement cable from the lance to the WM-1 are the primary reason for bad or missed measurements. In the event of a problem, first check the polarity, continuity, and insulation resistance of the thermocouple and lead wire. **Table 4** shows the maintenance guidelines with common issues, possible causes, and recommended actions.

### **NOTE**

SYSCON Sensors recommends that the WM-1 Digital Temperature Measurement System be checked against a voltage source such as a potentiometer of standard accuracy for calibration every three months to ensure its continued accuracy.

SYSCON Sensors provides repair and maintenance services including recalibration.

**Contact** us for calibration or for your individual maintenance and cabling needs.

**Table 4:** Frequent operating issues

Issue		Effect	Action
<b>Operating Practices</b>	Taking reading with furnace power ON	Multiple electrical grounds created	Turn furnace power OFF
	Slag thickness	Measurement probe doesn't penetrate to desired depth for an accurate and stable reading of molten metal temperature	Make measurements below the slag line

Issue		Effect	Action
	Excessive steel temperature	Thermocouple wire melts causing an open circuit condition	Check allowable operating temperatures for thermocouple types (see <b>Table 3</b> )
<b>Contact Block</b>	Regular wear and tear	Corrosion results in poor electrical contact	Clean inside surfaces with wire brush  Replace every 3 months or when probes become loose
<b>Measurement cable inside lance</b>	Overheating  <b>NOTE:</b> Since the insulation resistance of wires reduces at high temperatures, the instrument may show GREEN Ready Light. However, the temperature readings may be incorrect	Breakdown of the insulation resistance between the internal wires of the cable causing a short circuit between the conductors.	Replace lance cable
<b>External Measurement cable</b>	Regular wear and tear Flexing Hot metal splashes	Breakdown of insulation causing an open circuit condition	Replace external measurement cable
<b>Cable through a conduit or operator pulpit</b>	Overheating Humidity	Causes short circuit	Ensure cable <b>is</b> not located close to a heat source  Use an open wire tray for easy inspection



<b>Issue</b>		<b>Effect</b>	<b>Action</b>
	Power lines (high voltage wires) run along with measurement cable	Random deviation in readings	Isolate measurement cable from high voltage lines
<b>Thermocouple connectors</b>	Regular wear and tear	Faulty electrical connection	Replace when worn or erratic measurements are recorded

# Troubleshooting

Before proceeding with the troubleshooting guidelines, verify that the WM-1 is setup for the correct thermocouple type and calibration standard (IPTS 48, IPTS 68, or ITS 90). The calibration standard of the WM-1 should match that of the thermocouple tip used for temperature measurement.

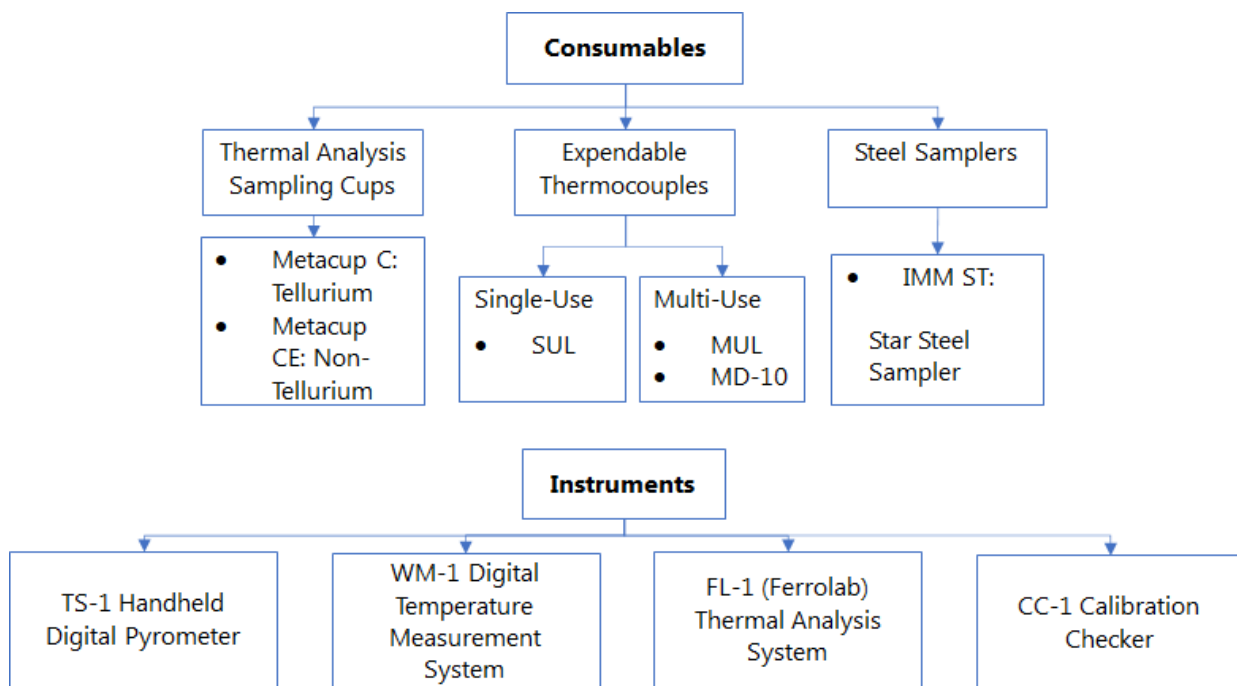
**Table 5:** Troubleshooting guidelines.

Error Message	Fault / Warning	Cause	Recommended Actions
9001	Slope Error	<ul style="list-style-type: none"> <li>• Thermocouple tip at end of life or defective</li> <li>• Lance not held steady.</li> <li>• Contact block overheated</li> </ul>	<ul style="list-style-type: none"> <li>• Replace thermocouple tip</li> <li>• Increase the dip time of the thermocouple tip</li> <li>• Increase time between successive temperature readings.</li> <li>• Fan cool thermocouple tip before dipping again</li> </ul>
9002	Noise Error	<ul style="list-style-type: none"> <li>• Improper furnace grounding</li> <li>• High voltage lines close to WM-1</li> <li>• Thermocouple tip end of life or defective</li> <li>• Lance not held steady</li> </ul>	<ul style="list-style-type: none"> <li>• Check furnace ground.</li> <li>• Avoid high voltage lines close to the WM-1</li> </ul>
9999	Broken Thermocouple or Open Circuit condition	<ul style="list-style-type: none"> <li>• Maximum operating temperature limit exceeded</li> </ul>	<ul style="list-style-type: none"> <li>• Change thermocouple tip</li> </ul>
	With thermocouple tip connected, WM-1 fails to signal <b>Green READY</b> light	<ul style="list-style-type: none"> <li>• Thermocouple tip end of life or defective</li> <li>• Contact block overheated or worn out.</li> <li>• Internal thermocouple cable worn out</li> </ul>	<ul style="list-style-type: none"> <li>• Replace thermocouple tip.</li> <li>• Replace contact block</li> </ul>

# Ordering Information

Ordering Information	
WM-1	WM-1 with 110V AC Power Cord Specify: Thermocouple type: S, K Specify: ITPS calibration: 48, 68, 90
LM-S-LL-BB	Measurement Lance, Type-S w 25' lead wire LL: Lance length: 36", 48", 60" BB: Bend radius: 00, 45, 90
LM-K-LL-BB	Measurement Lance, Type-K w 25' lead wire LL: Lance length: 31" , 43" , 55" , 72" BB: Bend radius: 00, 45, 90

**Figure 6:** SYSCON Sensor products for Foundries and Steel Mills



## Replacement Parts

**Table 6:** Replacement part numbers

<b>Part Number</b>	<b>Description</b>
CB-T1	Contact Block (type S)
LW-AT48S	Contact block (type S) and 5 feet (1.5 m) long type S Internal Steel Braided Thermocouple Wire


**NOTE**

SYSCON Sensors provides repair and maintenance services including recalibration.

**Contact SYSCON Sensors for individual maintenance and cabling needs.**

# Calibration Certificate

Calibration Certificate is available for IPTS 48, 68, and ITS 90 standards. SYSCON Sensors uses standards traceable to National Institute of Standards and Technology (NIST).

 <a href="http://www.sysconsensors.com">www.sysconsensors.com</a>		SYSCON International, Inc. 1108 High Street South Bend, IN 46601 (574-232-3900)																
<h2>CERTIFICATE OF CALIBRATION</h2>																		
<div style="border: 1px solid black; padding: 2px; display: inline-block;">20221014-101-WM1</div> Certificate Number																		
<b>Equipment</b> <b>Serial Number</b> <b>TC Type</b> <b>Name</b> <b>Address</b>	WM-1 XXX S	<b>PO#</b> <b>Procedure</b> <b>Standard</b> <b>Calibrated By</b>	WM-1 S_68_F IPTS 68 SYSCON Sensors 1108 High street South Bend, In 46601 Tel: (574) 232-3900															
<b>Calibration Date</b> <b>Calibration Due Date</b>		<b>Lab Temp</b> <b>Lab Humidity</b>	°F %															
<p>This is to certify that the above instrument was calibrated by SYSCON Sensors using standards traceable to National Institute of Standards &amp; Technology (NIST). The results indicated on this certificate relate only to the instrument calibrated. This certificate shall not be reproduced except in full without the prior written approval of SYSCON Sensors.</p>																		
<table border="1"> <thead> <tr> <th>Model</th> <th>Serial Number</th> <th>Description</th> <th>Calibration Date</th> <th>Calibration Due Date</th> </tr> </thead> <tbody> <tr> <td>TRCIII</td> <td>30902</td> <td>Omega Ice point cell</td> <td>10/14/2021</td> <td>10/14/2022</td> </tr> <tr> <td>HP3456A</td> <td>2512A17521</td> <td>6 ½ Digital Multimeter</td> <td>10/25/2021</td> <td>10/25/2022</td> </tr> </tbody> </table>	Model	Serial Number	Description	Calibration Date	Calibration Due Date	TRCIII	30902	Omega Ice point cell	10/14/2021	10/14/2022	HP3456A	2512A17521	6 ½ Digital Multimeter	10/25/2021	10/25/2022			
Model	Serial Number	Description	Calibration Date	Calibration Due Date														
TRCIII	30902	Omega Ice point cell	10/14/2021	10/14/2022														
HP3456A	2512A17521	6 ½ Digital Multimeter	10/25/2021	10/25/2022														
<b>Tolerance</b> TC Type S and B K	In °F ±3 °F ±3 °F	In °C ±2 °C ±2 °C	In mV ±0.021 mV ±0.060 mV															
<div style="border: 1px solid black; padding: 2px;">Condition: New Instrument</div>																		

**Figure 7:** Template Calibration Certificate for WM-1


 <a href="http://www.sysconsensors.com">www.sysconsensors.com</a>		SYSCON International, Inc. 1108 High Street South Bend, IN 46601 (574-232-3900)	
<h2>Report of Calibration</h2>			
Instrument	WM-1	Test Result	Pass
Serial Number	XXX	Cal Date	
Procedure	WM-1_S_48	Data type	Found-Left
Technician		Temperature	°F
		Humidity	%
<b>Instruments Used</b>			
<b>Model</b>	<b>Serial Number</b>	<b>Description</b>	
TRCIII	30902	Omega Ice point cell	
HP3456A	2512A17521	6 ½ Digital Multimeter	
<b>Test Results</b>			
Type S Calibration Points	STANDARD (V)	IPTS48	
		INSTRUMENT	
		As Found °F	As Left °F
2450 °F	13.658E-03	2450 °F	°F
2700 °F	15.319E-03	2700 °F	°F
3050 °F	17.618E-03	3050 °F	°F

Figure 8: Template for Report of Calibration for WM-1

## Contact Us

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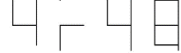


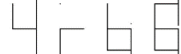














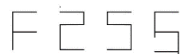





















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# Appendix: Glossary

All information on the main display is based on letters and numbers, which can be formed by the seven segments present on the LED displays. This glossary contains the explanations of letters and numbers used in the WM-1 Digital Temperature Measurement Systems which help the user to understand the information displayed.

**Table 7:** Display representations of messages in the 7-segment display

 <b>1</b>	 <b>8</b>	 Select type B <b>Tc b</b>
 <b>2</b>	 <b>9 or a or q</b>	 Select year 48 <b>yr48</b>
 <b>3</b>	 <b>0 or an or O</b>	 Select year 68 <b>yr68</b>
 <b>4 or a or Y</b>	 <b>A</b>	 Select Temp scale <b>SC F</b>
 <b>5 or an or S</b>	 <b>b or a or 6</b>	 Select Temp scale <b>SC C</b>
 <b>6 or a or b</b>	 <b>C</b>	 Parameter group A <b>PS-A</b>
 <b>7</b>	 <b>d</b>	 Parameter group B <b>PS-b</b>
 <b>Remote</b>	 <b>E</b>	 Final temp, time =255 <b>F255</b>
 <b>CAL</b>	 Max run time - 1 sec <b>r 1</b>	 Elapsed time, time = 10 <b>E010</b>
 <b>Cold End</b>	 Final Temp Time <b>F 10</b>	 Time format = 99mm.59 sec <b>G099</b>
 <b>Quit</b>	 Time Display Duration <b>E255</b>	 Time format = 999.9 min <b>G999</b>
 Type/year/scale <b>S/48/F</b>	 Ecal <b>ECAL</b>	 Delay time = 0 <b>d 0</b>
 Type/year/scale <b>r/68/C</b>	 Ecfg <b>ECFG</b>	
 Type/year/scale <b>b/68/C</b>	 Error code <b>9001</b>	
 Max run time - 15 sec <b>r 15</b>	 Error code <b>9002</b>	
	 Open TAC <b>OPEN</b>	
	 Select type S <b>Tc S</b>	
	 Select type R <b>Tc r</b>	



## Warranty

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SYSCON SENSORS warrants its product, when properly assembled and installed as recommended, to be free from defects in material and workmanship, under normal use and service, for a period of one year from the original date of purchase. Purchaser is requested to retain the invoice as proof of the purchase date. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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