

M668

Highly accurate, digital, flexible output

Pyrometer with focusable optics for non-contact temperature measurements on metals, ceramics, graphite etc. between 500 and 7200°F (250 to 4000°C)

- ◆ Temperature ranges between 500 and 7200°F
- ◆ Response time, 50 ms to 10 sec.
- ◆ Extremely small spot sizes, min 0.017 in. (0.4 mm)
- ◆ Built in digital display with temperature indication
- ◆ Precision sighting with optional built-in aiming light
- ◆ Interchangeable fiber optic cable
- ◆ Water and Dust proof NEMA 4 Housing
- ◆ Output selectable: 4-20 mA, 0-1V, K, S, R, B, W
- ◆ Focusable optics



The **M668** is a highly accurate, broad range pyrometer for non-contact temperature measurement on metals, ceramics, semiconductor etc. For optimal match of the instrument to the application 3 different focusable optics with extremely small spot sizes are available. The M668 can also have fixed focus lenses or very small diameter extension tip assemblies. The extension tip assemblies are available with stainless steel or ceramic sheath or as a crystal rod.

Two types of fiber optic cable can be supplied - the standard cable enclosed in an armored stainless steel sheath or a hermetically sealed cable with silicon rubber sheathing for exposure to oil and other liquids. The pyrometer parameters can be selected via the internal key pad, the settings are indicated on the built-in LCD-Display. In measuring mode the actual temperature is indicated.

Typical applications:

- preheating
- annealing
- tempering
- welding
- forging
- hardening
- sintering
- melting
- soldering
- rolling
- brazing
- normalizing

M668 fiber optic "Infraducer" features wide temperature range capability and adjustable focus lens

The M668 *Infraducer* is the most powerful and the most technologically advanced fiber optic infrared temperature measurement system used today. Models are available for highly accurate temperature measurement in ranges from 250°C (500°F) to 4000°C (7200°F) and accuracy specifications are NIST traceable.

The M668 consists of a fiber optic lens assembly enclosed in a stainless steel housing and connected to a signal processor (transmitter) by a fiber optic cable. The transmitter is enclosed in a water and dust-proof housing which exceeds NEMA 4 rating.

The M668L model features an aiming light actuated by a key switch on the side of the transmitter housing. This facilitates aiming and focussing on the target area more precisely and quickly.

Focussable lens assembly available

Two types of lens assemblies are available: variable focus and fixed focus. The fixed focus is offered on both the M668 and M668L. The variable focus is only available on M668L since it is used in conjunction with the integral light source to determine when the target area is in focus.

The barrel of either lens assembly is threaded for convenient mounting. When mounted within a companion air cooling jacket it can withstand ambient temperatures up to 500°C (930°F).

Choice of circular or rectangular F.O.V.

Two alternative shapes of field of view are available with the M668 and M668L *Infraducers*. The standard, circular field of view can be used for most applications. However, the rectangular field of view is desirable for elongated targets such as wires and rods.

User selectable temperature range and output

The user has freedom to select both the temperature range and output signal on site. The output signal can be selected from current, voltage or a variety of thermocouple characteristics. The 4-20mA and 0-1 volt outputs allow the user to field scale the temperature range in 50° F or C increments to meet his specific requirements. No calibration is necessary when changing outputs or scale.

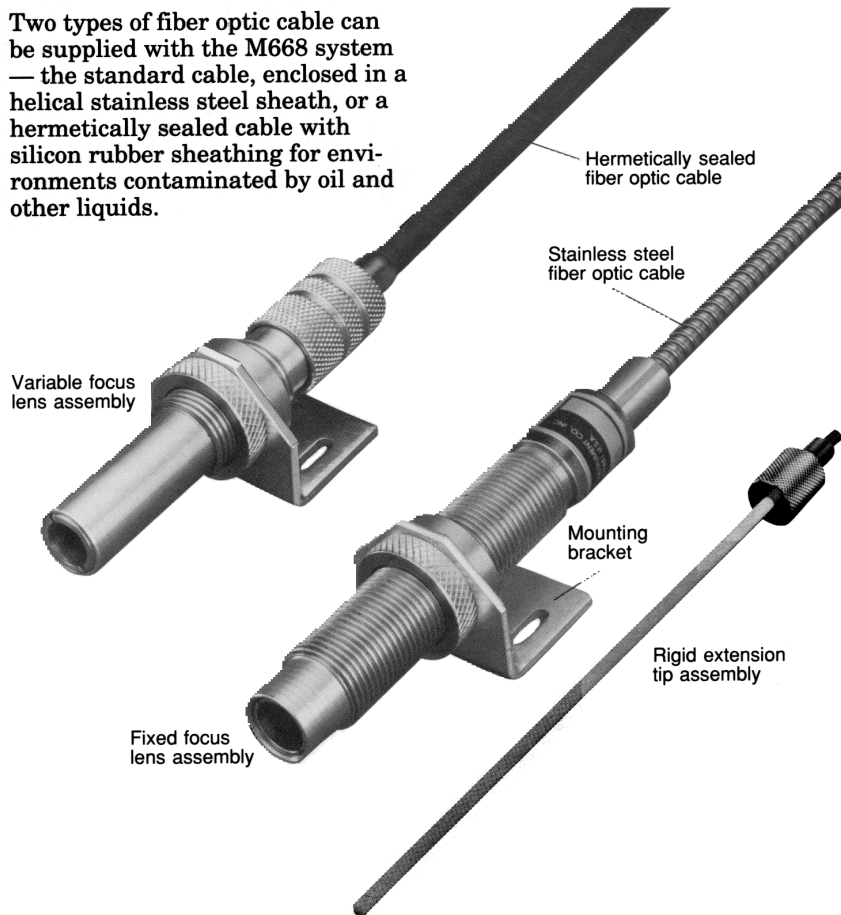
Interchangeable fiber optic cables

The M668 system also offers the advantage of interchangeability of optical fibers through a plug-in fiber coefficient that eliminates the need for calibration when the fiber optic cable is changed.

Two types of fiber optic cable can be supplied with the M668 system — the standard cable, enclosed in a helical stainless steel sheath, or a hermetically sealed cable with silicon rubber sheathing for environments contaminated by oil and other liquids.



Temperature transmitter — Alphanumeric LCD (8 characters x 2 lines) displays temperature and output type. Enclosure of temperature transmitter of M668 meets NEMA 1 through 13 requirements.



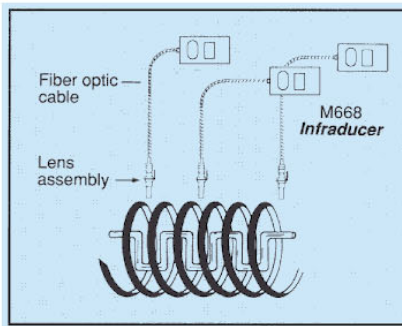
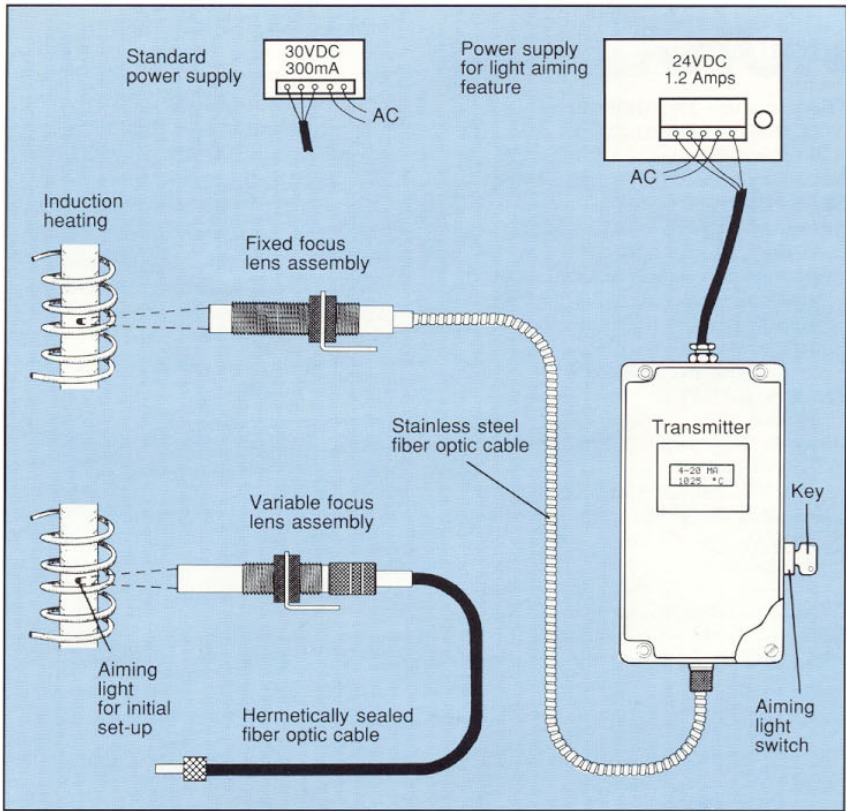
Choice of different spectral response

The M668 and M668L *Infraducers* have 3 alternative spectral responses. In general, the temperature range selected should be the one which is associated with the shortest spectral response because this will result in the smallest measurement errors due to incorrect or variable emissivity. If the temperature data obtained with the M668 is being compared with, or verified by an Optical Pyrometer (Disappearing Filament Pyrometer), the preferred spectral response is 0.65 microns, since this is identical to that of the Optical Pyrometer.

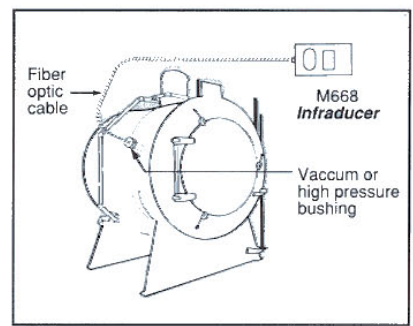
Applications

The fiber optic M668 extends the potential of infrared thermometers into the following problem applications:

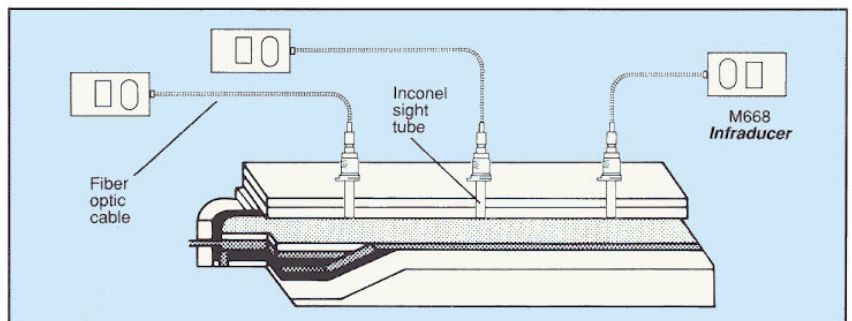
- (a) Applications where straight line sighting with conventional infrared instrumentation is difficult or impossible. The flexibility of the fiber optic cable overcomes this problem.
- (b) Environments where RF or EMI interference cause measurement errors or failure, requiring the electronics to be placed away from the source of interference. High powered induction heating furnaces are typical of this type of application.
- (c) High ambient temperature applications where conventional water cooling of the sensor head is impractical or undesirable. For example, on the roof of furnaces, forehearths, glass melting tanks, kilns, etc. The M668 fiber optic tips can withstand up to 315°C (600°F) ambient temperature without the need for cooling.
- (d) Corrosive or unusually obscured environments, or applications where fumes or other atmosphere pollutants prohibit conventional methods of temperature measurement.
- (e) In vacuum applications where sighting through the window is difficult or impossible, a fiber optic cable can be placed inside the vacuum vessel using a vacuum bushing.



Induction Heating — This illustration indicates how the M668, with its fiber optic feature, can be used at multiple locations along the length of the object being heated to measure the temperature at critical points to assure uniformity of treatment.



Vacuum Melting — In vacuum furnaces often sighting through a window is difficult or undesirable. In this application a fiber optic lens assembly is placed inside the vessel, using a vacuum bushing. Since the M668 with 0.65 micron spectral response is least affected by emissivity variation, it is also ideal for direct sighting temperature measurement of molten metal.



Forehearth/Furnace — Model M668 *Infraducer* is specifically suitable for the glass industry to improve control in melter, refiner, regenerator and forehearth applications.

How to Select an M668 "Infraducer"

Step No.

1. Select either the M668 or the M668L *Infraducer* version and place the selected model No. in box No. 1. Model M668 is the most basic version. Model M668L has a built-in target illumination capability.
2. Select desired spectral band and temperature range. The working temperature range you require must be within the selected range, but can be a portion of it since the M668 is USER SCALEABLE. Place the proper code number in box No. 2.
3. Select either a circular or rectangular field of view shape and place the proper code number in box No. 3. Rectangular field of view is desirable for narrow targets such as wires providing that the wire is longer than the long dimension of the field of view.
4. Select either non-hermetically sealed or hermetically sealed fiber optic cable type. Hermetically sealed cables are better for environments contaminated by oil and other liquids but must not be used in ambient temperatures greater than 260°C (500°F). Place the proper code number in box No. 4.
5. Select the length of fiber optic cable and insert code number in box No. 5. Check Table 1 to ensure that fiber length selected is within the maximum allowable length.
6. Select the lens assembly from the listed focus options and insert code number in box No. 6. If an extension tip is to be used in place of a lens assembly, the code number in box No. 6 should be selected from the chart under Rigid Extension Tip.
7. Select the proper field of view ratio and insert code number in box No. 7. Check with table 1 to ensure that the desired FOV ratio is consistent with temperature range and fiber optic cable length.

BASIC MODEL	TEMPERATURE RANGE		SPECTRAL RESPONSE	CODE	FIELD OF VIEW SHAPE		CODE	FIBER OPTIC CABLE TYPE		CODE	FIBER OPTIC CABLE LENGTH (SEE TABLE 1.)		
	°C	°F			CIRCULAR	RECTANGULAR		FLEXIBLE STAINLESS STEEL SHEATHING	FLEXIBLE HERMETICALLY SEALED SILICON RUBBER SHEATHING		FT	CM	CODE
M668 OR M668L	250 - 800	500 - 1450	1.0 - 1.60	Q1	CIRCULAR	S	FLEXIBLE STAINLESS STEEL SHEATHING	S	3	90	03		
	300 - 1200	600 - 2150		Q2					6	180	06		
	400 - 2000	750 - 3600		Q3	12	360			12				
	500 - 2000	950 - 3600	0.78 - 1.06	H1	FLEXIBLE HERMETICALLY SEALED SILICON RUBBER SHEATHING	H			18	540	18		
	600 - 2400	1150 - 4350		H2					24	720	24		
	800 - 3000	1500 - 5400		H3					30	900	30		
900 - 2500	1650 - 4500	NARROW BAND CENTERED AT 0.65 (SEE NOTE 1.)	V1										
1200 - 3500	2250 - 6300		V2										
1600 - 4000	2900 - 7200		V3										

Example: M668L-H2/SH12/1-090 has a maximum temperature span of 600°C to 2400°C with circular field of view, 12 feet (360cm) long hermetically sealed fiber optic cable, variable focus lens assembly focussable from 10.00" (25cm) to infinity with light beam targetting, and a field of view of 90:1.

Notes

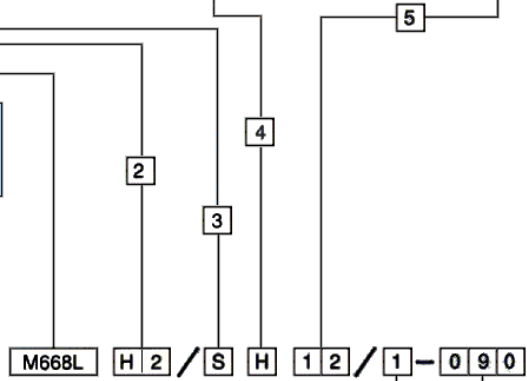
1. The 0.65 micron spectral response is preferred for variable emissivity applications where the temperature range permits.
2. To determine the minimum target size use the following formula.

$$\text{Min. target size (d)} = \frac{\text{Focussed Distance (D)}}{\text{FOV Ratio}}$$

Sample: Determining minimum target size for focus distance of 40.00" (1m) and FOV of 60:1
 Min. target size (d) = $\frac{40.00'' (102\text{cm})}{60.00'' (152\text{cm})} = .66'' (1.7\text{cm})$
3. 3:1 FOV is for extension tip only.

Table 1: When you have selected a Range Code, Table 1 can be used to determine what field of view and FO cable length limitations apply. Start from the range code and refer first to the "STANDARD" column. If the standard limitations are unacceptable, the "OPTIONAL" column will indicate alternatives such as a greater maximum cable length if a wider FOV is acceptable.

OPTIONAL			STANDARD			
MAXIMUM AVAILABLE FIBER OPTIC CABLE LENGTH	OPTIONAL FIELD OF VIEW RATIO	RANGE CODE	STANDARD FIELD OF VIEW RATIO	MAXIMUM AVAILABLE FIBER OPTIC CABLE LENGTH	LENS & TIP ASSY FIXED FOCUS	LENS ASSY VARIABLE FOCUS
N.A.	N.A.	Q1	3:1			
		Q2	15:1			
30' (9m)	30' (9m)	Q3	60:1 150:1 X 30:1			
60' (18m)	54' (16.2m)	H1	30:1	30' (9m)	12' (3.6m)	
	36' (10.8m)	H2	90:1			
	45' (13.5m)	H3	300:1			
	54' (16.2m)	V1	90:1			
	45' (13.5m)	V2	180:1			
	60' (18m)	V3	300:1			



RIGID EXTENSION TIP LENGTH	CODE	LENS ASSEMBLY VARIABLE FOCUS DISTANCE	CODE	FIELD OF VIEW RATIO (SEE TABLE 1.)	CODE
3.00" (75mm)	A	10.00" TO INFINITY 25cm TO INFINITY	1	SEE NOTE 3 3:1	003
6.00" (150mm)	B	6.00" TO 10.00" 15cm TO 25cm	2	15:1	015
12.00" (300mm)	C	2.00" TO 5.00" 5cm TO 12.5cm	3	30:1	030
				60:1	060
				90:1	090
				180:1	180
				300:1	300
				RECTANGULAR 150:1 X 30:1	R60

Accessories

Protective cooling jacket and air purge assembly

This assembly is designed to protect the lens assembly of the M668 *Infraducer*. It performs two very important functions — purging and localized cooling. Air purging of the optics is extremely important on applications where airborne contaminants can build up on the lens and eventually “blind” the optics.



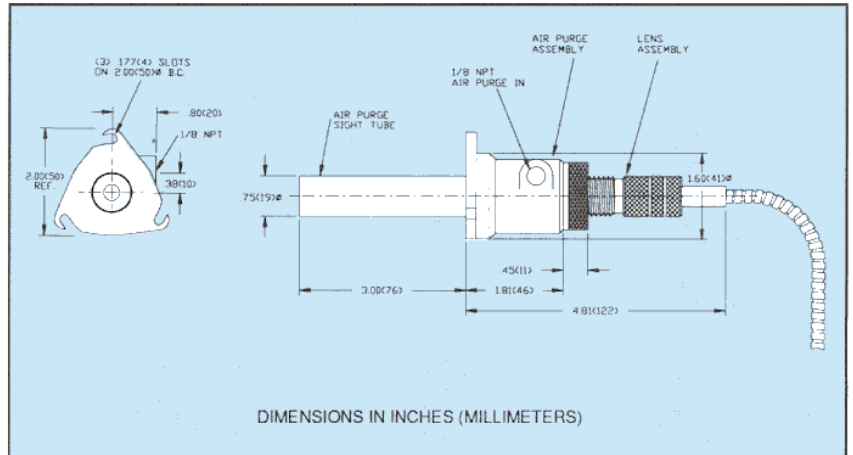
The M668 air purge assembly has been carefully engineered to prevent the build-up of contaminants. A flow of only 20CFH (0.5 CMH) of normally clean industrial air will keep the optics clean under most industrial conditions.

In high ambients, when the temperature exceeds the maximum rated temperature of the lens assembly, the use of coolant is mandatory. Air flow alone is sufficient for most cooling. An air flow of only 100CFH (2.5CMH) is sufficient for ambient temperature of up to 500°C (930°F).

To order: Specify P.N. 14296-1

Sight tubes

Standard sight tube material for M668 air purge assembly is stainless steel and it is 75mm (3.0”) long. Other materials such as inconel, silicon carbide and refractory alumina are also available. The following sight tube lengths are standard: 75mm, 150mm, 300mm, 450mm, 600mm and 900mm.



Aiming flange assembly

Used in installations requiring durable mounting of the standard lens assembly while allowing adjustment of the optical path to a maximum of 5° in any direction. This spring loaded mounting flange provides additional isolation from heat and vibration conducted to the lens assembly from adjacent equipment.

To order: Specify P.N. 14349-1

Fiber optic vacuum bushing

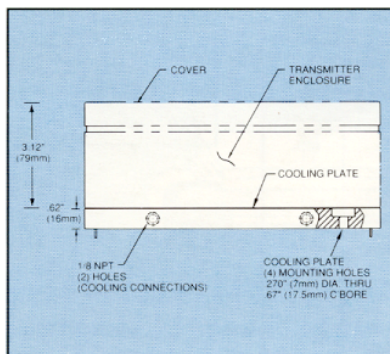
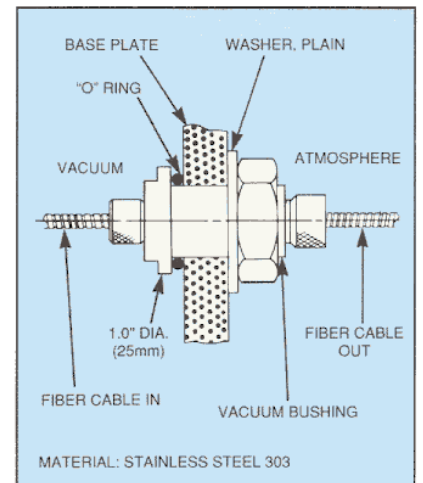
In vacuum applications where sighting through a window is difficult or impossible, a fiber optic cable can be placed inside the vacuum up to 10^{-8} torr with the aid of this bushing. The bushing holds a bundle of fiber optics which is sealed for high vacuum application. This system seals the vacuum and allows for removal of the cable on either side of the bushing without affecting the integrity of the vacuum seal.

To order: Specify P.N. 12506-1

Cooling plate

This assembly is designed to protect the M668 transmitter in environments of high ambient, when temperature exceeds 50°C (122°F). A water flow of 10 gal/hr (40 liters/hr) is sufficient for ambient temperature of up to 80°C (175°F).

To order: Specify P.N. 13919-1



M668 Infraducer Specifications:

Temperature Display: Alphanumeric LCD. 8 character x 2 lines. Displays temperature and set-up prompts.

Accuracy: ±0.5% of reading ±1 digit

Resolution: 1°C or 1°F

Repeatability: ±0.1% of reading ±1 digit

Response Time: 50 mS to 10 seconds: internally adjustable with set-up prompt keys. Response time is defined as time required for output to reach 95% of final value.

Emissivity: 0.10 to 1.0 in 0.01 steps digitally set

Output: 4-20 mA, 0-1 volt linear. Thermocouple types K, S, R, B & all type W's. All cold junction compensated. Outputs are electrically isolated from input power supply. Only one output is available at any one time. 4-20 mA and 0-1 volt outputs are field scaleable by user in 50 degree increments in either C or F. All scaling is by user interface with alphanumeric display prompts. No calibration required when changing outputs or scale.

Power Requirements: 15 to 40VDC (24VDC typical), 150 mA without aiming light. 1.2 A with aiming light. Unregulated supply acceptable.

Load Resistances: 400 ohms max. for 4-20 mA output at 24VDC supply. No less than 10,000 ohms load for 0-1VDC output. Thermocouple outputs must use thermocouple extension wire of same type for wiring between M668 and external indicator.

Enclosure Material: Aluminum.

Enclosure Electrical Rating: NEMA 1 through 13

Weight: (2.0kg) 4.4 lbs.

Fiber Optic Lens Mounting: Included adjustable bracket, optional air purge system, or 3/4-16 thread.

Fiber Optic Lens Focus Method: On variable focus, collet chuck type adjustment. Aiming light used for determining when in focus.

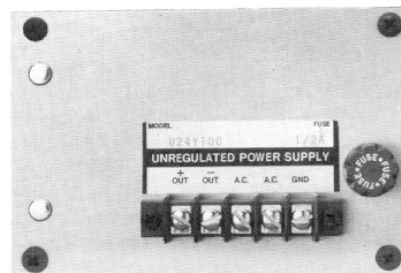
Fiber Optic Cable Material: Glass fibers in bundle form protected by flexible stainless steel sheath or in hermetically sealed sheath consisting of stainless steel with silicon rubber outer layer. Min. bend radius 2" (50mm).

Aiming Light: Actuated by key switch on side of housing. Provides aiming and focussing light through fibers without removing fiber optic cable from housing. When light is activated, display flashes and analog outputs hold last reading just prior

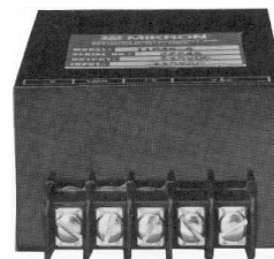
Power Supplies

Two power supplies are available for use with the M668 *Infraducer*. The smaller unit has a 300 mA output and is used when the aiming light is not required; the larger 1.2 A power supply is used with the aiming light. The front-mounted terminal barrier strip is perfect for isolation between input and output voltages. A current limiting feature protects the power supply when short circuit occurs. Four tapped holes are provided for mounting.

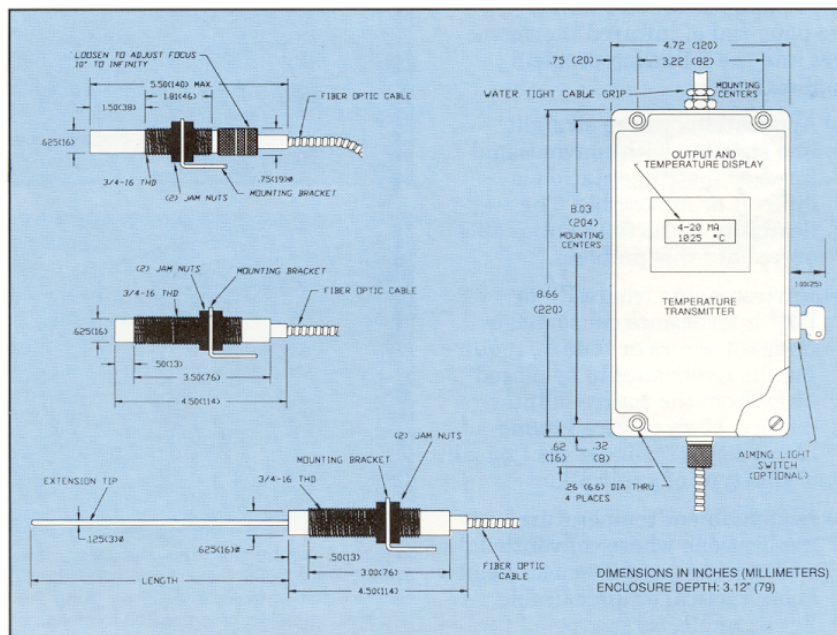
Input Voltage	Output Voltage	Max. Load Current	Part Number
115VAC 230VAC	30VDC regulated	300 mA	11846-6 11846-7
115VAC 230VAC	24VDC unregulated	1.2 Amps	14026-2 14026-3



Power supply for Model M668L with light aiming feature



Standard power supply for Model M668



to turning light on. Temperature readings and light cannot operate simultaneously.

Operating Ambient Temperature:

- a) Signal processor: 0 to 50°C (32 to 122°F) With cooling plate: 0 to 80°C (32 to 175°F)
- b) Lens and tip assembly: - 60 to 315°C (- 75 to 600°F) Lens assembly with cooling jacket: up to 500°C (930°F) max.
- c) Fiber optic cable: stainless steel: - 60 to 315°C (- 75 to 600°F)

Hermetically sealed silicon rubber: - 40 to 260°C (- 40 to 500°F)

Made in U.S.A.

The M668 *Infraducer* is designed and built by Mikron, the leading innovator in infrared thermometry. Manufacturing facility is located in Oakland, NJ.

Warranty

M668 *Infraducers* are covered by a two-year warranty period.

Mikron Infrared Inc.

16 Thornton Road
Oakland, NJ 07436

Tel: (201) 405-0900
Fax: (201) 405-0090

E-Mail: info@mikroninfrared.com
Internet: www.mikroninfrared.com

