# GENERAL®

# DATA LOGGING
# HOT WIRE ANEMOMETER with
# CFM/CMM and 8:1 IR THERMOMETER

## *USER'S MANUAL*



# CIH20DL

*Please read this manual carefully and thoroughly before using this product.*

# TABLE OF CONTENTS

# INTRODUCTION

Thank you for purchasing General Tools & Instruments' CIH20DL Data Logging Hot Wire Anemometer with CFM/CMM and 8:1 IR Thermometer. Please read this user's manual carefully and thoroughly before using the instrument.

The CIH20DL is a professional-grade, handheld hot wire anemometer that can not only measure the speed of air exiting the grille or register of an HVAC/R system or blower or fan, but also convert those readings to airflow volume measurements in units of CFM (cubic feet per minute or $ft^3$/min) or CMM (cubic meters per minute or $m^3$/min). The conversions are possible because the meter allows the user to enter the free area dimensions of grilles and output ductwork.

The instrument can also measure the temperature of cooling or heating air, as well as surface temperatures. Air temperatures from 32° to 158°F (0° to 70°C) are measured by a thermistor located next to the hot wire sensor at the end of a 6 ft. (1.8m) long telescoping metal probe and cable. Surface temperatures from -25° to 999°F (-32° to 538°C) are measured by an integral infrared (IR) thermometer with a distance-to-spot (D:S) ratio of 8:1.

A hot wire anemometer measures air speed in the following way. When the instrument is powered on, direct current is passed through its hot wire sensor for about 15 seconds. After the sensor has been warmed to a constant temperature, the instrument detects how much current is required to maintain that temperature as wind passing across the sensor acts to cool it. The amount of current required is directly proportional to the square of the wind speed.

Hot wire anemometers are as accurate as vane anemometers, but hot wire units are better able to measure very slow air currents because they have no moving parts and therefore no inertia. For example, the CIH20DL can measure air speeds as low as 2 ft/min. A typical vane anemometer of comparable quality and accuracy cannot measure air speeds lower than 80 ft/min.

The CIH20DL has a large backlit display with three readouts: one shows air speed or airflow volume, another is for IR temperature, and the third is dedicated to air temperature. Normally, each of these readouts shows real-time measurements, which can be held (frozen) and read later to enable work in dark areas. End users can opt to have the readouts show maximum, minimum or average measurements instead. End users also can store up to nine sets of the three readings (air speed or airflow volume, air temperature and IR temperature) in an internal nonvolatile memory and recall them at any time in chronological order.

In addition to storing the nine sets of readings, the CIH20DL also can capture—over long periods of time—and time-stamp up to 20,000 air speed/airflow volume, air temperature and surface temperature measurements at a user-selected sampling rate from 5 seconds to 1 hour. These time-stamped readings, called data logs, can be copied to a PC running Windows® 7, Windows® Vista or Windows® XP via an included USB cable. Once in the computer, the logs can be displayed as graphs or tables, formats that make it easy to spot trends or unexpected excursions in readings.

Windows® 7, Windows® Vista and Windows® XP are registered trademarks of Microsoft Corporation.

The CIH20DL can be configured to display air speed in any of five Imperial or metric units, airflow volume in CFM or CMM, and temperature in degrees Fahrenheit or Celsius. The instrument's IR thermometer, which can be precisely aimed by a low-power laser pointer, assumes by default that its target has an emissivity of 0.95, which is true for 90% of applications.

The meter is normally powered by one "9V" battery (included). To enable long-term data logging, the meter also can be powered by a 110V or 220V AC supply. When the meter is powered by the battery, it automatically shuts off after 10 minutes of inactivity to extend battery life. When running on AC power, the auto power off period is extended to 30 minutes when the meter is not in data logging mode. When the meter is running on AC power in data logging mode, the auto power off function is disabled to enable logging sessions longer than 30 minutes. When the meter is connected to a computer via the included USB cable, the meter is powered through the computer's USB port. In this mode, the Auto Power Off function is disabled. This prevents unexpected meter shutoffs from interrupting data uploads.

# KEY FEATURES

- Measures and displays air speed or airflow volume in several Imperial or metric units
- Simultaneously measures and displays ambient temperature from 32° to 158°F (0° to 70°C) in °F or °C with ±2% accuracy
- Measures air speeds from 2 ft/min to 7874 ft/min (20 mm/sec to 40 m/sec) with ±3% accuracy
- Measures airflow volumes from 0 to 2.5 million CFM (0 to 72,000 CMM) with ±3% accuracy
- Displays maximum, minimum or maximum air speed plus temperature
- Also has 8:1 infrared thermometer for remote, non-contact measurement of surface temperatures from -25° to 999°F (-32° to 538°C) with ±3% accuracy
- Telescoping probe and cable extend reach of hot wire sensor and thermistor to up to 6 ft. (1.8m)
- Jumbo backlit LCD with three readouts
- Stores/recalls up to nine sets of three readings in nonvolatile memory
- Time-stamps and saves up to 20,000 data points at user-selected sampling rate from 5 seconds to 1 hour
- Included USB cable and interface/data logging software enable transfer of stored data logs from the meter's internal memory to a PC for tabular or graphic display and analysis
- Data hold and auto power off functions
- CE and RoHS approved

# SAFETY INSTRUCTIONS

**CAUTION!**

The ClH20DL's targeting laser is a Class II type that emits less than 1mW of power between 630nm and 660nm. Avoid direct eye contact with laser light radiation. U.S. law prohibits pointing a laser beam at aircraft; doing so is punishable by a fine of up to $10,000 and imprisonment.

# WHAT'S IN THE CASE

The ClH20DL and its accessories come in a custom molded plastic case. The instrument itself has two main components: a handheld meter with a digital display, and a telescoping metal probe with two sensors at one end and a plug for connecting the probe to the meter at the other. Also in the case are the following accessories:

- A USB cable for connecting the meter to a Windows computer, enabling the meter to upload captured air speed, airflow volume and surface temperature data. This cable has a mini B-type plug at one end and an A-type plug at the other.

- An AC adapter and power cable for connecting the meter to a 110V or 220VAC supply to enable long-term data logging. This cable has a mini B-type plug at one end and a socket with a spring-loaded latch at the other. The latch makes it easy to attach and detach either of two kinds of plugs: one with American-style blades and the other with European-style round prongs. One plug of each type is included in the case.

- A "9V" Alkaline battery.

- A plastic bag containing: 1) a CD with Windows-compatible software and drivers for using the ClH20DL with a PC running Windows7 (32- or 64-bit), Windows Vista or Windows XP; 2) a Certificate of Traceable Calibration; and 3) this user's manual.

# PRODUCT OVERVIEW

Fig. 1 shows the labels and positions of the controls and connectors on the front and top of the ClH20DL. Fig. 2 shows all possible indications on the LCD. Familiarize yourself with the controls' functions and the meanings of the display indications before moving on to the Setup Instructions.

1. ⏻ **(Power) button**
2. **LCD with three readouts**
3. 🔳 **(Record) button:** When pressed briefly, stores values shown on all three readouts in one of nine nonvolatile memory locations, and then advances the location counter by one. When pressed and held for 3+ seconds, begins logging measurement data (air speed or airflow volume, air temperature and IR temperature) at preset sampling time. Logs are stored in the meter's internal memory space (as opposed to in nonvolatile memory). Also used to change fields when setting sampling time, date or time and to clear the meter's internal data logging memory space.

4. ![IR Temp] **button:** Activates laser pointer when enabled (unless readouts are displaying recalled values)

5. ▼ **button**

6. ![HOLD] **(Anemometer HOLD) button:** Freezes air speed and airflow volume readings only

7. **AC power/USB cable jack (on left side)**

8. ![laser/backlight] **A two-function button:** Laser pointer enable/disable and backlight on/off. Pressing button four times cycles through the four possible combinations of states (see figure below). After the backlight is activated, it stays on for 15 seconds and then automatically shuts off.
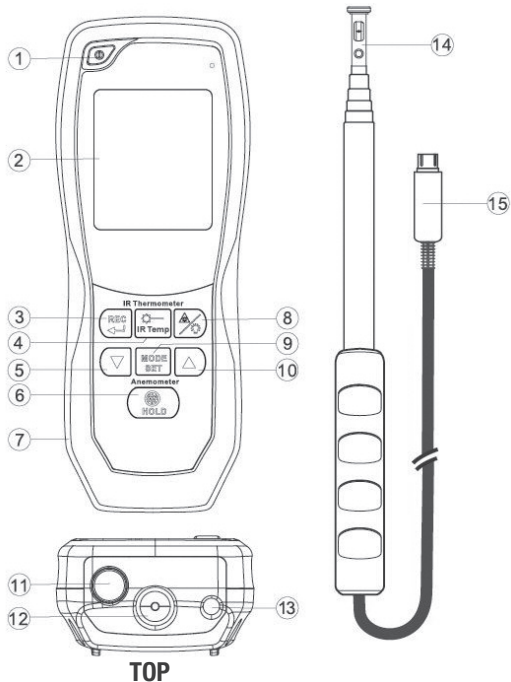
**Fig. 1. The CIH20DL's controls and connectors**



**TOP**



| Backlight OFF Laser Disabled | Backlight ON Laser Disabled | Backlight OFF Laser Disabled | Backlight ON Laser Disabled |
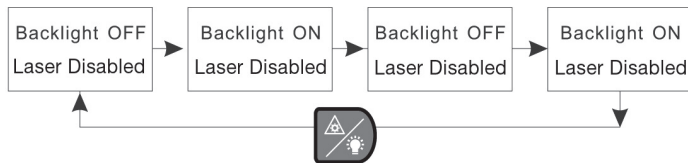
9. **MODE SET button:** When pressed briefly and repeatedly, cycles readouts to show: real-time measurements; maximum, minimum and average readings; and recalled stored measurements.

When pressed and held for 3+ seconds (unless readouts are displaying recalled values), places meter in advanced setup mode. In this mode, the user can change default measurement units, enter a grille area, set the data logging sampling time and the current date and time, and clear the meter's data logging memory space.

10. ▲ **button**
11. **Hot wire probe socket**
12. **IR measuring window**
13. **Laser pointer port**
14. **Hot wire probe head**
15. **Hot wire probe plug**
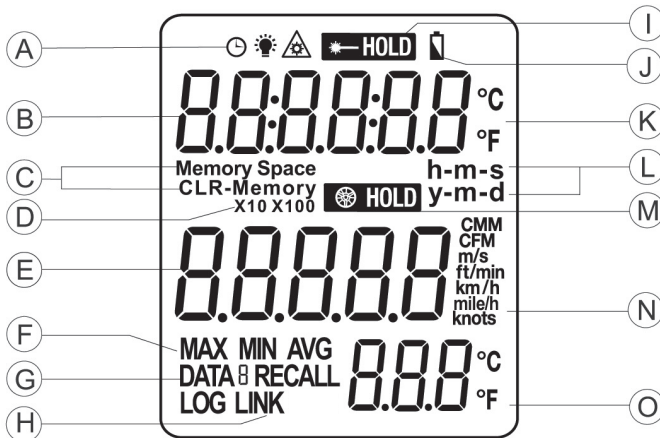
**Fig. 2. All possible display indications**

A   Clock, backlight on and laser pointer enabled icons

B   Secondary readout

C   Memory Space/CLR (clear) and Memory indications

D   X10 and X100 indications

E   Primary readout

F   MAX, MIN and AVG display indications

G   DATA [#] RECALL and DATA LOG indications

H   [PC] LINK indication

I   [IR Temperature] HOLD indication

J   Battery charge indicator

K   IR temperature measurement unit (°C or °F)

L   Time and date field indications

M   [Anemometer] HOLD indication

N   Air speed and airflow volume measurement units

O   Tertiary readout

# SETUP INSTRUCTIONS
## *INSTALL BATTERY*

The meter's battery compartment is accessible from the back of the unit (Fig. 3).

Before installing the 9V battery included in the carrying case, remove the plastic covering its terminals. Open the battery compartment by pushing the tab at the bottom of its cover forward (Fig. 3, Step 1). Lift the cover and set it aside (Step 2). Then plug the battery into the wired socket inside the compartment. The terminals of the battery and the socket mate in only one way, with the smaller male terminal plugging into the larger female terminal. Replace the battery compartment cover and push down on its bottom until it snaps shut.



**Fig. 3. The back of the CIH20DL**

The CIH20DL also can be powered by connecting it to an AC outlet or a computer's USB port. There is no reason to do so unless you plan to use the meter for extended data logging sessions. Connecting the meter to an external power supply does not charge the included "9V" Alkaline battery, which is not rechargeable.

See "Data Logging with a Computer", beginning on p. 14, for ways to connect the CIH20DL to an external power source.

# OPERATING INSTRUCTIONS
## *GETTING STARTED*

To prepare the CIH20DL for use, line up the hot wire probe plug (Fig. 1, Callout 15) with the hot wire probe socket on the top of the meter (Callout 11) so the black arrow on the probe connector faces the back of the meter. Then insert the probe plug into the socket.

Before extending the telescoping probe, extract the probe head (Callout 14) from the probe body by grasping the round black plastic end piece (Fig. 4 left, top callout) with two fingers and pulling slowly. Take care not to touch either the hot wire air speed sensor or the air temperature sensor within the head; both are extremely delicate. Pull out the probe head to expose 1 inch of probe body. Exposing the probe head now will allow you to telescope the probe to any length later by grasping its body rather than its delicate head.



**Fig. 4. The probe head assembly**

Following each measurement session, carefully push the probe head back into the probe body (Fig. 4, right) in order to protect the sensors.

**To power on the meter**, press the ⏻ button. The display will initially show the clock icon at upper left and numbers on the primary readout counting down from 15. The numbers track the time needed to heat the hot wire to prepare it for use. After 15 seconds, the meter will be ready for use. It will automatically enter "normal" (air speed or airflow volume + temperature) measurement mode and display a screen similar to Fig. 5. By default, the primary (middle) readout shows real-time air speed in ft/min and the tertiary (lower) readout shows real-time air temperature in degrees Fahrenheit. The secondary (upper) display also uses °F as its default unit.
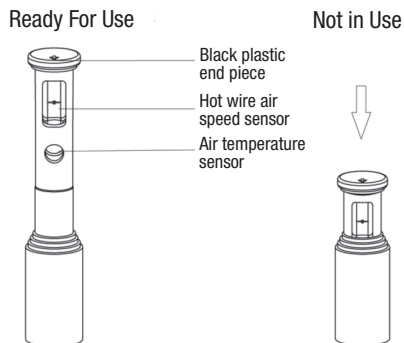
**To change the default air speed or temperature unit**, skip ahead to "Using the Advanced Settings Menu," beginning on p. 12.

### *MEASURING AIR SPEED AND TEMPERATURE*

**To measure the speed and temperature of a blower's or HVAC system's output**, fully extend the telescoping hot wire probe and position the head of the probe in the airstream leaving the system's duct or register. Be sure the black arrow on the round black plastic end piece points in, or opposite to, the direction of air flow (see Fig. 6). The primary (middle) readout will show the air speed in ft/min and the tertiary (bottom) readout will show the temperature of the airstream in °F.



**Fig. 5. The initial display after powering on**

When making air speed or airflow volume measurements, it's important to **make sure the air flows directly through the larger window in the probe head containing the hot wire**. If some of the airflow goes around the cavity, the hot wire will not be cooled to the maximum extent, and air speed and airflow volume measurements will consequently be low. To ensure that the hot wire is perpendicular to the airflow, slowly twirl the probe while watching the primary (middle) readout. When the highest values are seen, the hot wire is fully perpendicular to the flow of air.

### *MEASURING AIRFLOW VOLUME*

**To prepare to measure the amount of air exiting a duct, grille or register**, first measure its area. Then skip ahead to "Using the Advanced Settings Menu" beginning on p. 12. Following the instructions in Fig. 8,  use the **MODE SET** button and the ▼ and ▲ buttons to 1) place the meter in airflow volume measurement mode and 2) enter the area of the duct, grille or register.

Once you have measured and entered the area, fully extend the telescoping hot wire probe and position the head of the probe in the airstream. Make sure the hot wire window is perpendicular to the airstream, as when measuring air speed. The primary (middle) readout will show the airflow volume in the default unit of CFM (cubic feet/minute) and the tertiary (bottom) readout will show the temperature of the airstream in °F.



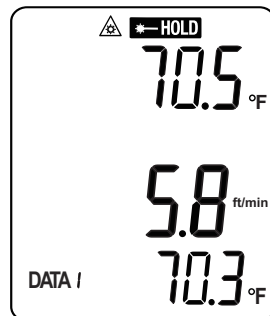**Fig. 6. How to orient the hot wire probe**

## MEASURING SURFACE TEMPERATURE

**To use the meter's IR thermometer to measure the surface temperature of an object from a distance**, make sure the meter is in "normal" measurement mode, with the primary (middle) readout tracking air speed or airflow volume and the tertiary (lower) readout tracking air temperature. Then make sure the laser pointer is enabled (indicated by the ⚠ icon at the top of the display). It may be necessary to press the 🔆 button once or twice to enable the pointer.

With the laser pointer enabled, point the top of the meter at an object or surface and press the ▣ button. The IR thermometer will measure the surface temperature and show it on the secondary (upper) readout. Note that releasing the ▣ button turns off the laser pointer and causes the measurement to be held (indicated by the return of the ▣ HOLD icon above the measurement). All IR temperature measurements are automatically held on-screen until the ▣ button is pressed again or the meter is powered off—whichever comes first.

To improve your surface temperature measurements, learn to determine how close to the target the ClH20DL must be so the area whose temperature you wish to measure is within the spot area of the meter's IR thermometer. Refer to the Appendix, which begins on p. 24, for the theory and practice of making accurate IR measurements.

## HOLDING AND STORING MEASUREMENTS

To hold any pair of measurements (air speed + temperature or airflow + temperature) made by the sensors in the probe head, press the 🔘 button. This will freeze the value shown on the primary readout and cause the 🔘 HOLD icon to appear above it. Held measurements are erased when the meter is powered off

To release the hold, press the 🔘 button again.

The ClH20DL contains enough nonvolatile memory to store nine sets of three readings (air speed or airflow volume, air temperature and surface temperature. **To store a set of three measurements**, first make sure the meter is in "normal" measurement mode or measurement hold mode. Then note the number to the right of the word DATA at the lower left of the display and briefly press the 🔘 button. Doing so will store the values shown by all three readouts in the indicated memory location and then advance the location counter by one. The new number (DATA X +1) is the memory location that will be used the next time the 🔘 button is pressed.

While the readings are being stored, the meter will continue to operate in normal measurement mode. In contrast to held readings, readings stored in nonvolatile memory are not erased when the meter powers off. However, a reading will be overwritten if its memory location is next in the queue when the 🔘 button is pressed.

## DISPLAYING MAXIMUM, MINIMUM AND AVERAGE VALUES

The **MODE SET** button is the gateway to two multi-option menus. The menu that opens depends on how long you press the button. Pressing the **MODE SET** button briefly lets you choose to display values other than real-time measurements on the three readouts. Pressing and holding the button opens up the Advanced Settings Menu, which is detailed in the next section, beginning on p. 12.

Fig. 7 is a flowchart of the menu made available by briefly pressing the **MODE SET** button. Starting from normal measurement mode, one press of the button makes all three readouts show the maximum values of the three main parameters measured since the meter was powered up. The term **MAX** appears at the lower left of the display to indicate what the readings represent.

Measuring Mode — Normal Measuring Mode

MAX — Three readouts show maximum values since power on

MIN — Three readouts show minimum values since power on

MODE SET

AVG — Three readouts show average values since power on

RECALL — Three readouts show the parameters stored together at the same in nonvolatile memory
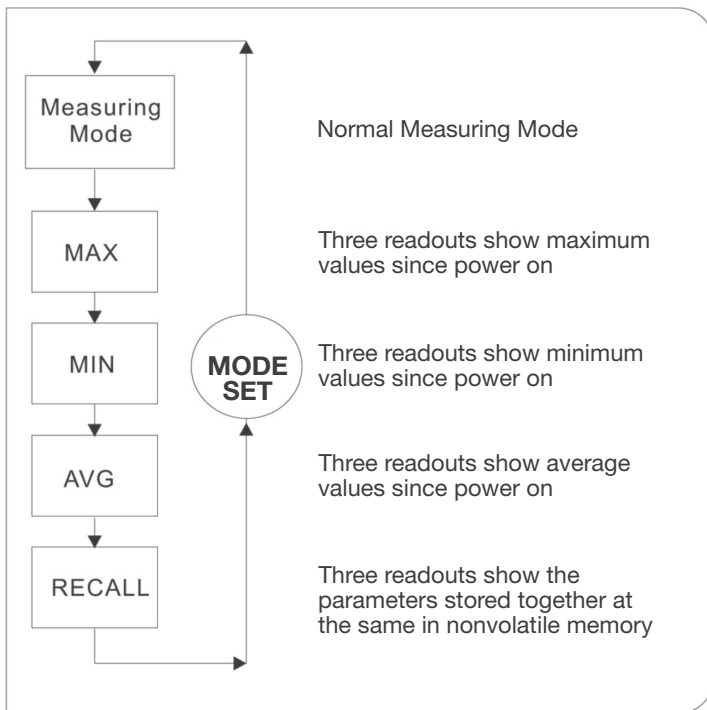
**Fig. 7. The menu made available by briefly pressing the MODE SET button**

Pressing the **MODE SET** button again switches the readouts to show the minimum (**MIN**) values of the three parameters measured since the meter was last powered on. Pressing the button a third time switches the readouts to show the average (**AVG**) values of the three parameters.

### *RECALLING AND ERASING STORED READINGS*
Pressing the **MODE SET** button a fourth time begins retrieval and display of the measurements stored in nonvolatile memory. The first set of three values retrieved are the three measurements most recently stored. Their memory location is indicated by the word **DATA** and a number from 1 to 9 at the lower left of the display. The word **RECALL** appears at the right of the number to indicate that the three readouts are showing stored values.

To retrieve other triple sets of measurements in either order (newest to oldest, or oldest to newest), use the ▼ and ▲ buttons, respectively. For example, if the first set of values retrieved (the most recently stored) is tagged **DATA2**, pressing the ▼ button would retrieve the values stored in memory location DATA1. These represent the next oldest measurements, compared to DATA2. To continue retrieving data using a reverse timeline (newest to oldest), continue to press the ▼ button.

To retrieve measurement data using a forward timeline (oldest to newest), use the ▲ button.

Whichever timeline you choose, when you reach memory location DATA0 (either by moving up from DATA9 or down from DATA1) the display will change radically. **DATA0 RECALL** will appear on the bottom line and all three readouts will show dashes instead of measurement values and units. That's because DATA0 is a non-storing memory location. In addition, the letters **CL** and **CLE** will be superimposed on the dashes of the secondary and primary readouts. Also, the words "**Memory Space CLR-Memory**" will appear in the space between **CL** and **CLE**.

This unique display gives you the opportunity to bulk-erase the meter's nonvolatile memory. To do so, press the [REC] button. This will cause the entire primary readout (the letters **CLE** superimposed on dashes) to flash continuously, indicating that all stored measurements have been erased. To confirm the erasure, repeatedly press either the ▼ or ▲ button and note that all **DATA [X] RECALL** displays now show three readouts with dashes rather than measurement values.

To return the meter to normal measurement mode after bulk-erasing the nonvolatile memory, press the **MODE SET** button.


### USING THE ADVANCED SETTINGS MENU

Pressing and holding the **MODE SET** button for 3+ seconds opens up the meter's second multi-option menu, the Advanced Settings Menu. Figure 8 is a flowchart of the options made available from this menu by subsequent brief presses of the **MODE SET** button. Once you have entered the Advanced Settings Menu (indicated by the word **SET** on the bottom line of the display), moving to the next box down the flowchart requires only a brief press of the **MODE SET** button. Pressing *and holding* the **MODE SET** button exits the Advanced Settings Menu and returns the meter to operating in normal measurement mode.

Unlike the first virtual menu accessible from the **MODE SET** button, the Advanced Settings Menu gives you only six seconds to choose an option at each decision box moving down the flowchart. If no button is pushed within six seconds, the menu closes and the meter resumes operating in normal measurement mode. Once you gain experience using the meter, you will find that six seconds is sufficient to exercise any option presented by the menu.

## Fig. 8. The Advanced Settings Menu

| Menu Step | Instructions |
|---|---|
| Normal Measuring mode | Press and hold the **MODE SET** button for 3+ seconds to enter/exit menu from/to normal measuring mode. |
| Air Speed or Airflow Volume mode | Press the ▼ or ▲ button to select **CMM, CFM** (for Airflow Volume mode) or **m/s, ft/min, km/h, mile/h, knots** (for Air Speed mode). When your choice flashes, press the **MODE SET** button to store it. |
| Air speed unit | Press the ▼ or ▲ button to select **m/s, ft/min, km/h, mile/h** or **knots**. When your choice flashes, press the **MODE SET** button to store it. |
| Airflow volume unit | Press the ▼ or ▲ button to select **CMM** or **CFM**. When your choice flashes, press the **MODE SET** button to store it. |
| Temperature unit | Press the ▼ or ▲ button to select **°F** or **°C**. When your choice flashes, press the **MODE SET** button to store it. |
| Enter area of grille or register | Press (and hold, if convenient) the ▼ or ▲ button to adjust the value on the primary readout to the measured area. The area can be adjusted from 0.01 to 322.92 ft² in increments of 0.01 ft², or from 0.001 to 30m² in increments of 0.001 m². After entering the correct area, press the **MODE SET** button to store it. |
| Sampling time of data log | Use the button to toggle between the minutes and seconds fields of the time shown on the secondary readout. Use the ▼ and ▲ buttons (holding them, if convenient) to adjust the flashing value within each field. The sampling time can be set to any value between 5 seconds (00:00:05) and 59 minutes, 59 seconds (00:59:59). After entering the desired sampling time, press the **MODE SET** button to store it. |
| Clear data logging memory | Press the button to clear the meter's internal data logging memory. Doing so resets the five-digit Memory Space counter and causes it and the text **CLR-Memory** above it to flash, confirming the erasure. After six seconds, the meter will automatically exit the Advanced Settings Menu and enter normal measuring mode. |
| Set current date | Use the button to toggle between the year, month and day fields of the date shown on the secondary readout. Use the ▼ and ▲ buttons (holding them, if convenient) to adjust the flashing value within each field. After entering the current date, press the **MODE SET** button to store it. |
| Set current time | Use the button to toggle between the hours, minutes and seconds fields of the time shown on the secondary readout. Use the ▼ and ▲ buttons (holding them, if convenient) to adjust the flashing value within each field. Remember to use the 24-hour format when setting the hour. After entering the current time, press the **MODE SET** button to store it. |

**MODE SET**

## DATA LOGGING WITH A COMPUTER

In addition to making and displaying real-time air speed, airflow volume and temperature measurements and storing up to nine sets of these readings in nonvolatile memory, the ClH20DL also can make and time-stamp up to 20,000 measurements over extended periods of time at user-selected sampling rates. These measurements, called data logs, are stored in a separate internal memory. They can be uploaded to a PC using the USB cable and interface/driver/data logging software provided with the instrument.

After uploading, the data logs can be analyzed for trends and anomalies using the software's presentation options. Examples include graphical and tabular displays of data that make it easy to spot excursions of air temperature or gradual decreases in airflow volume over time.

### Install Software and Drivers

1. Place the installation disc, shiny side down, in your computer's CD/DVD drive and close the drawer.

2. Double-click the icon "Run setup.exe", or the icon representing the disc to initiate AutoPlay. The screen shown in Fig. 9 will appear.

3. Click **Next** to install the anemometer's application program (Anemometer AP, Version 3) in your C:\Program Files (x86) folder in a new subfolder named <ST73X>. (If you want to install the software elsewhere, click **Browse** and choose another location.) Doing so will also install software for other National Instruments products in another new Program Files subfolder named <National Instruments>.
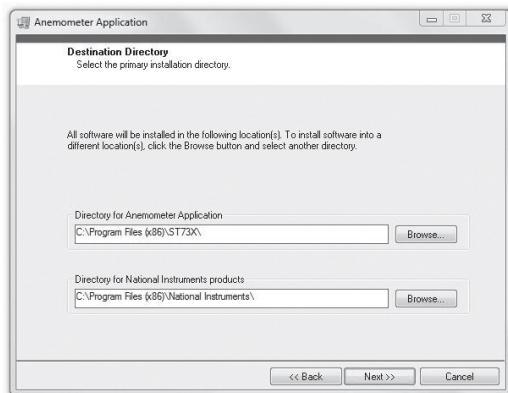


**Fig. 9. The initial software installation screen**

4. On the next dialog box (the National Instruments Software License Agreement), click the circle to the left of "I accept the License Agreement" and then click **Next**.

5. On the next dialog box (the License Agreement), again left-click the circle to the left of "I accept the License Agreement" and then left-click **Next**.

6. On the next dialog box (Start Installation), click **Next**. On some computers, the two software installations may take as long as 20 minutes.

7. When the next dialog box (Installation Complete) notifies you that "The installer has finished updating your system," click **Next**.

8. The next dialog box prepares for installation of the PL-2303 USB-to-Serial driver on your computer. Click **Next** to continue.

9. When the next dialog box (InstallShield Wizard Complete) appears, click **Finish**.

**10.** You may or may not be prompted now to restart your computer to complete installation of the Anemometer Application. If you are prompted to do so, click **Restart**.

Whether or not you restart, note that an Anemometer Application icon has been added to your desktop, start button, or both locations. To facilitate access to the program, right-click on whichever icon has been added and pin it to both locations and your taskbar. You can now eject the installation disc and store it with your other important software.

## Connecting the Meter to Your Computer

Before using the CIH20DL to log data, familiarize yourself with how the meter and the software you have just installed work together.

To begin, connect the meter to your computer by plugging the mini B-type plug of the included USB cable into the jack on the left side of the meter (Fig. 1, Callout 7). Next, insert the A-type plug at the other end of the cable into an open USB port of your computer. Power on the meter and wait 15 seconds for the hot wire sensor to heat up to operating temperature.

The first time you connect the meter to your computer, the system tray at lower right will pop-up two notifications: 1) "Installing Device Driver Software", followed by "Prolific USB-to-Serial COMM Port ((COM[X])) Device Driver Software Installed Successfully". Depending on which Windows OS you are running and which USB port you have chosen, the "X" in "(COMX)" may be any number from 1 to 9. **Write down the number shown in the notification**. Knowing the number will speed up each subsequent connection of the meter to your computer—as long as you use the same USB port each time.

The interface/data logging software is now ready to be used with the CIH20DL.

## Viewing Real-Time Measurements on the Dashboard

The software installations should have added an "Anemometer AP" or "Anemometer Application" icon to your Start button and/or desktop, and/or an "IR-A" icon to the Quick Start (left) section of the taskbar at the bottom of your computer screen.

Open the Anemometer AP program via the icon on the Start button, desktop or Taskbar. Two overlaid screens will appear (see Fig. 10).

The larger, bottom screen is called a dashhboard and it serves the same purpose as the dashboard of a vehicle: displaying all important measurements in one place. The smaller, top screen will show a pulldown menu of COM port selections at right, with a default COM port selection of COM4.
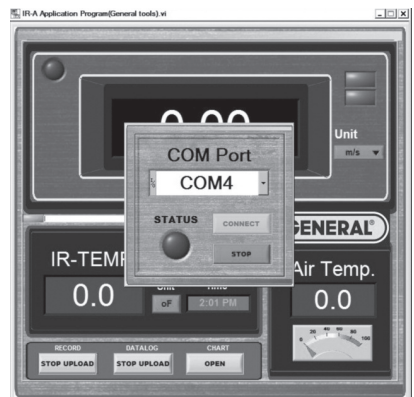


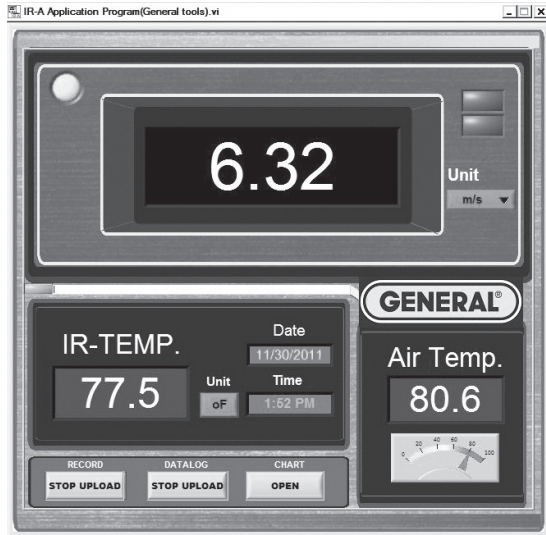**Fig. 10. The startup Anemometer Application screen**

**Fig. 11. the Anemometer Application's dashboard**

To access the dashboard, you must use this pulldown to select the number of the COM port you are using to connect the meter. This is the number you were advised to write down earlier. If you have forgotten it, you can still identify the "correct" port by trial and error.

Selecting the correct COM port will illuminate the green **STATUS** light on the small overlaid screen and make the **CONNECT** virtual button available to press. You may need to refresh the COM Port window until the number of the COM port into which you plugged the USB cable appears.

Once the **STATUS** light on the smaller screen illuminates, click on **CONNECT**. A successful connection will cause the smaller screen to disappear, enabling the dashboard (Fig. 11) to appear in full and begin mirroring real-time readings on the meter's LCD. The connection will also cause the word **LINK** to appear on the bottom line of the meter's LCD.

## WARNING!

If your computer is running the 64-bit version of Windows7, NEVER disconnect the CIH20DL from the computer (by unplugging either end of the USB cable) without first closing the Anemometer AP (IR-A) application. Disconnecting the meter while the application is running will cause your computer to crash (shut down hard, with the same consequences as losing power or pressing and holding the POWER button) every time. When your computer crashes, all open applications will close immediately and all of your unsaved work will be lost.

If you do not know which version of Windows7 you are running, right-click the "My Computer" icon on your desktop or double-click "Computer" in Windows Explorer. In the "System" section, the "System type" line will indicate whether you are running the 32-bit or 64-bit version of Windows7.

On the dashboard, the default units are °F for temperature and m/s for air speed. To change the air speed unit, left-click the red box containing **m/s** and select one of the four other units as the default. To switch to °F as the IR and air temperature unit, click on **°F** in the red box. These defaults must be reset each time you the open the program.

### Using the Meter to Log Data

Before logging data, **close the Anemometer AP program and disconnect the CIH20DL from your computer in that order** (see Warning on p. 16). You should then use the Advanced Settings Menu (see p. 12 and following) to set the current time and date in the meter. Doing so will give the data you log an absolute temporal reference point, making it more credible and valuable. The Advanced Settings Menu also allows you to use air speed and temperature units other than the default m/s and °F, respectively.

Finally—and most important—the Advanced Settings Menu enables you to determine the optimum value of sampling time for the purposes of your application. Using the shortest setting of 5 seconds may result in too much essentially identical data being stored in memory, potentially limiting its capacity to capture important events such as an unexpected excursion of temperature or humidity. Conversely, using the longest sampling time setting of 59 minutes, 59 seconds will likely cause important events to go undetected.

If you are an experienced data logger, you already know how to choose the optimum sampling time for your application. If you are a novice, pick a sampling time closer to the minimum than the maximum sampling time, on the assumption that the meter probably has enough memory (20,000 sets of readings) to store all the data you ask the meter to log—unless you use it to log data for months, rather than weeks or days.

Because most data logging is done over a long period of time, General recommends that you change the meter's power supply from its 9V battery to an external source of AC power before beginning a logging session. Running on AC power enables the meter to log data indefinitely, not just until the battery discharges.

**To switch to AC power**, attach the correct type of plug for your locale (American-style blades or European-style round prongs) to the socket of the supplied power cable. The top of each plug has square corners. Push the lip on the plug's top edge at an angle into the slot in the top of the socket's cavity (marked by an arrow). Then push the bottom of the plug down and into the cavity until the spring-loaded latch secures it. Finally, insert the mini B-type plug end of the power cable into the USB jack on the side of the meter (Fig. 1, Callout 7) and plug the other end into an AC outlet.

**To begin logging data**, extend and secure the probe as the application dictates and then press and hold the **REC** button for at least 3 seconds. This will cause the phrase **DATA LOG** to appear on the bottom of the meter's LCD.

**To stop logging data**, press and hold the **REC** button again. This will cause the **DATA LOG** indication to disappear. Once the meter exits Data Logging mode, it will automatically power off in 30 minutes (assuming you plugged it into an AC outlet for the logging session, as recommended earlier). Finally, disconnect the cable applying AC power from both the meter and the AC outlet. Using the instructions above as a guide, reconfigure the power cable as a USB cable by detaching the power plug from the socket at the cable's mini-A plug end.

Be aware that after you reconfigure the power cable as a USB cable and before you connect the meter to your computer, the meter will automatically resume drawing power from its internal battery. The switch will re-enable the Auto Power Off function, which will then automatically power the meter off if no buttons on it are pushed within any 10-minute interval.

When you connect the meter to your computer via the USB cable for the purpose of uploading data (the subject of the next section), the meter will begin drawing power from the computer's USB port. The connection will disable the Auto Power Off function to prevent unexpected interruptions of data transfers between the meter and your computer.

### Uploading Record Data

At any time after ending a data logging session, connect the meter to your computer by inserting the mini-B plug at one end of the cable into the jack on the side of the meter, and the mini-A plug at the other end into an open USB port of your computer. Power on the meter and open the Anemometer AP program.

Once the meter is connected to your computer, you can upload two different kinds of data to the PC. The first kind—"Record" data—comprises sets of three parameters (air velocity, air temperature and IR temperature) whose newest values represent real-time measurements and which stretch backward in time from the present. The data is "rolled over" (oldest values are overwritten to make room for newer values) continuously. Record data is analogous to video data that a digital video recorder (DVR) records continuously as long as it is powered on. On most consumer DVRs, you can retrieve video received at any time from the present until one hour ago (unless the channel is changed). On the CIH20DL, the length of the corresponding "reverse time" interval is a function of the default sampling time.

**To upload this Record data**, click on the **STOP UPLOAD** virtual button under **RECORD** at the bottom of the dashboard (see Fig. 11). The button label will change to **UPLOAD**. Wait a minute or two, and then click on **UPLOAD**.

You will then be prompted to choose a storage location for this .txt/.xlsx Data Record file. You can also rename the file now. To avoid confusing this file and other files, General suggests that you add the date as a suffix to the generic "Data Record" file name and store the file on your computer's desktop. Once you have done so, click the **OK** button of the dialog box.

Locate the file on your desktop, double-click on its icon, and open the file in Microsoft Excel, Microsoft Notepad or Microsoft WordPad. Depending on the version of Excel you are using, you may be prompted to verify the integrity of the file (by clicking **Yes**) prior to opening it.

Note the tabular format of the data as well as the column headings and the time stamps (the third column in Notepad and WordPad, and Column C in Excel). As explained earlier, Record data comprises three sets of readings (IR Temperature, Air Velocity and Air Temperature) that are expressed in default units and displayed in chronological order starting at the time the meter was connected to your computer and ending at the present time. Also note from the table that Record data is captured as often as several times per second (some hour:minute:second time stamps have up to three entries, while others have none or one).

## Viewing Record Data Graphically

You can also view Record data by using the dashboard's integrated chart function. With the meter connected to your computer (indicated by a green light at the upper left of the dashboard and the word **LINK** on the bottom line of the meter's LCD, click on the **OPEN** virtual button under **CHART** at the bottom of the dashboard. A screen similar to Fig. 12 will appear on your computer's display. Note that only two parameters (air velocity and air temperature) are plotted because they are the only values that the meter captures automatically when powered on and operating unattended in Data Logging mode. The IR temperature data contained in the tables generated by uploaded .txt/.xlsx Data Record files are not plotted.

The dashboard's chart function is useful for quickly viewing trends in ambient air speed and temperature values captured by the probe since the meter was last powered on. Unlike Record data, the data in plots generated by the dashboard's chart function are not—and cannot be—given absolute date and time stamps.

You can, however, make this plotted data easier to correlate with tables of uploaded Record data by changing the plots' x-axis label via the dashboard. To do so, right-click on any of the three icons in the graph palette (below the m/s and °F buttons shown in Fig. 12). Using the pulldown menu, select **Visible Items**, and left-click **Scale Legend** to put a check mark to its left. You can also change the units of the air speed and temperature plots by clicking their red virtual buttons. As an example, compare Fig. 13 to Fig. 12. On Fig. 13, the scale legend has been changed from **Numbers** to **Sample No.**, and the unit of air speed measurement has been changed from m/s to ft/min.
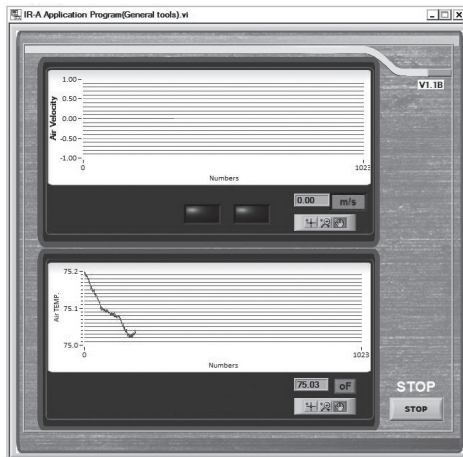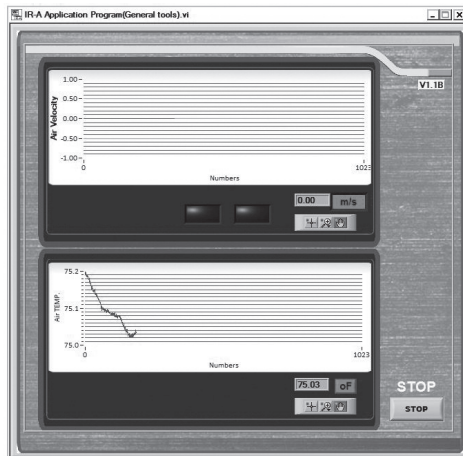


**Fig. 12. The initial CHART display, activated from the dashboard**



**13. A modified CHART display**

Other selections in the pulldown menus that appear when you right-click on any of the three icons of the graph palette can be used to:

• Make other chart items visible

• Auto-scale plots along their X and Y axes

• Export images

• Copy data

• Change the way that plots are updated

• Add descriptions and tips to charts

It is also possible to left-click on two of the three icons of the graph palette. Doing so enables you to manipulate Record data plots using two powerful techniques: zooming and panning:

• If you left-click on the center icon of the graph palette—the Zoom button—six display options will appear for selection. Clicking on the icon in the middle of the bottom row turns the left button of your computer's mouse, touch pad or trackball into a "zoom lens" through which you can greatly increase the resolution of the data in plots of air velocity and air temperature vs. time.

• Left-clicking on the right icon of the graph palette turns your mouse, touch pad or trackball into a panning control. Doing so changes the icon of your cursor into a hand. When placed within a plot area, moving the hand left or right shifts the time axis forward or backward.

The remaining two sets of three interactive icons on the dashboard are located at the bottom left, below the plots. The icon at left—a lock—is called the **Scale Lock** button. Left-click it to toggle in and out of autoscaling for each plot. To the right of the **Scale Lock** button are two icons—called **Scale Format** buttons—that you can right-click to configure the format, precision and mapping mode of plotted data, set the visibility of the scale and scale label, and change the grid and plot colors.

### Uploading and Viewing Data Logs

To upload your data logs, click on the **STOP UPLOAD** virtual button under **DATALOG** at the bottom of the dashboard. When you do so, the button label will change to **UPLOAD** and the orange segment of the progress bar running horizontally across the middle of the dashboard will turn green and slowly grow longer to the right. When the bar stops growing, click on **UPLOAD**.

As was the case for Record data, you will then be prompted to choose a storage location for this .txt/.xlsx DataLog file. Add the date as a suffix to the generic "DataLog" file name and store the file on your computer's desktop. Once you have done so, click the **OK** button of the dialog box.

Locate the file on your desktop, double-click on its icon, and open the file in Microsoft Excel, Microsoft Notepad or Microsoft WordPad. As before, depending on the version of Excel you are using, you may be prompted to verify the integrity of the file (by clicking **Yes**) prior to opening it.

Note the tabular format of the data as well as the column headings and the time stamps (the third column in Notepad and WordPad, and Column C in Excel). **Like Record data**, Data Logs comprise three sets of readings (IR Temperature, Air Velocity and Air Temperature) that are expressed in default units and displayed in chronological order. **Unlike Record data**, the time stamps of Data Logs begin when you started data logging and stop when you stopped logging. Also, unlike Record data, Data Log data points are captured at the sampling rate you selected (or the previous default sampling rate, if you chose not to select a new rate) before beginning a data logging session.

Finally, note that when you upload data logs, all logs in the instrument's memory are uploaded, not just the logs of your most recent session. **To clear the data logging memory in the CIH20DL**, follow the instruments for the "Clear Data Logging Memory" box of the flowchart (Fig. 8) on p. 13.

Instructions for optimizing the graphical presentation of data logs are beyond the scope of this manual. Using Excel, rather than Notepad or WordPad, to open data log files offers the most options for viewing flexibility.

# SPECIFICATIONS

| | |
|---|---|
| Air Speed Measurement Range | 2 ft/min to 7874 ft/min (20 mm/sec to 40 m/sec) |
| Air Speed Measurement Basic Accuracy | ±3% of reading |
| Air Speed Measurement Resolution | 0.1 ft/min; 0.01 m/s; 0.01 km/h; 0.01 mph; 0.01 knots |
| Airflow Volume Measurement Range | 0 to 2.5 million CFM (0 to 72,000 CMM) |
| Airflow Volume Measurement Basic Accuracy | ±3% of reading |
| Airflow Volume Measurement Resolution | 1 CMM; 1 CFM from 0 to 99,999 CFM; 10 CFM from 100,000 to 999,999 CFM; 100 CFM from 1,000,000 to 2,500,000 CFM |
| Air Temperature Measurement Range | 32° to 158°F (0° to 70°C) |
| Air Temperature Measurement Basic Accuracy | ±3% of reading |
| Air Temperature Measurement Resolution | 0.1°F (0.1°C) |
| IR (Surface) Temperature Measurement Range | -25° to 999°F (-32° to 538°C) |
| IR Temperature Measurement Accuracy | ±5.4°F (3°C) from -25° to -4°F (-32° to 20°C); ±3.6°F (2°C) from -4° to 212°F (-20° to 100°C); 2% of reading from 212° to 999°F (100° to 538°C) |
| IR Temperature Measurement Resolution | 0.1°F (0.1°C) |
| IR Thermometer Emissivity | 0.95 (fixed) |
| IR Thermometer Distance-to-Spot Ratio | 8:1 |
| Airflow Register Area Range | 0.01 to 322.92 ft$^2$ in increments of 0.01 ft$^2$, or 0.001 to 30m$^2$ in increments of 0.001 m$^2$ |
| Sampling Time Range | 5 seconds to 59 minutes, 59 seconds |
| Internal Measurement Storage Capacity | 9 sets of 3 readings |
| Internal Data Log Storage Capacity | 20,000 points |
| Auto Power Off | After 10 minutes of inactivity on battery power; after 30 minutes of inactivity on AC power; disabled when meter is running on AC power in Data Logging mode |
| Backlight Duration | 15 seconds |
| Display Size | 1.69 x 2.4 in. (33 x 51mm) |
| Operating Temperature | 32° to 122°F (0° to 50°C) @ 10 to 90% RH |
| Storage Temperature | 14° to 140°F (-10° to 60°C) |
| Dimensions of Instrument | 7.24 x 2.75 x 1.57 in. (184 x 70 x 40mm) |
| Weight of Instrument | 11.3 oz. (320g) |
| Extended Length of Telescoping Probe and Cable | 70.8 in. (1.8m) |
| Power Source | 1 "9V" battery (included) |
| Dimensions of Protective Carrying Case | 10.88 x 10.50 x 2.88 in. (276 x 267 x 73mm) |
| Weight of Instrument, Accessories and Case | 44.5 oz. (1.26kg) |

# MAINTENANCE TIPS

Remove the battery before storing the meter for an extended period of time.

Do not drop or disassemble the meter or immerse it in water.

# WARRANTY INFORMATION

General Tools & Instruments' (General's) CIH20DL Data Logging Hot Wire Anemometer with CFM/CMM and 8:1 IR Thermometer is warranted to the original purchaser to be free from defects in material and workmanship for a period of one year. Subject to certain restrictions, General will repair or replace this instrument if, after examination, the company determines it to be defective in material or workmanship.

This warranty does not apply to damages that General determines to be from an attempted repair by non-authorized personnel or misuse, alterations, normal wear and tear, or accidental damage. The defective unit must be returned to General Tools & Instruments or to a General-authorized service center, freight prepaid and insured.

Acceptance of the exclusive repair and replacement remedies described herein is a condition of the contract for purchase of this product. In no event shall General be liable for any incidental, special, consequential or punitive damages, or for any cost, attorneys' fees, expenses, or losses alleged to be a consequence of damage due to failure of, or defect in any product including, but not limited to, any claims for loss of profits.

# RETURN FOR REPAIR POLICY

Every effort has been made to provide you with a reliable product of superior quality. However, in the event your instrument requires repair, please contact our Customer Service to obtain an RGA (Return Goods Authorization) number before forwarding the unit via prepaid freight to the attention of our Service Center at this address:

> General Tools & Instruments
> 80 White Street
> New York, NY 10013
> 212-431-6100

Remember to include a copy of your proof of purchase, your return address, and your phone number and/or e-mail address.

# APPENDIX



mm  25@200  50@400  75@600

inches  1@8  2@16  3@24

D:S=8:1   Numbers indicate spot size@distance
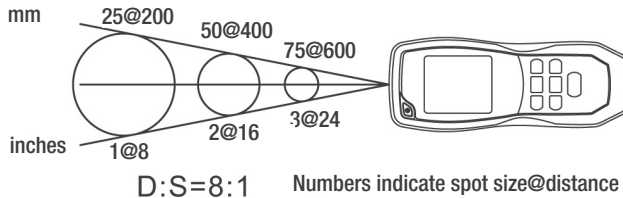
**The field of view of the CIH20DL's IR thermometer**

## HOW TO MAKE ACCURATE IR MEASUREMENTS

The CIH20DL has a distance-to-spot (D:S) ratio of 8:1. This means that the target area (spot) whose infrared radiation (temperature) is being measured increases in diameter by 1 inch for every 8 inches you move *away* from the target. Conversely, the diameter of the target area measured decreases by 1 inch for every 8 inches you move closer to the target.

All IR thermometers (IRTs), including the CIH20DL, take the average temperature of all objects within a circular target area (spot). Although the distance "D" in the D:S ratio is defined as a linear value and the "S" defines the diameter of the spot (see above figure), the critical parameter is the target area. Depending on the distance to the target (the object whose temperature you want to measure), the target area may include both the target and background objects near or behind the thermometer's field of view, which defines the target area or spot.

To explain the relationship between D:S ratio and measurement accuracy, consider how the CIH20DL would be used to measure the temperature of a small AC motor suspected of overheating. The motor measures approximately 1 ft. x 1 ft., so it has an area of 1 $ft^2$. If the CIH20DL is used to make the measurement from 24 ft. away, the reading will have a large error. At this distance, the target area is 3 $ft^2$. Therefore, the CIH20DL will measure not just the temperature of the motor, but also the temperature of the physical surroundings in its field of view, and average the two readings.

How inaccurate would the measurement be? If the motor's operating temperature is 200°F and the background temperature is 75°F, and the motor's area is half the target area at the measurement distance, the following equation gives the average temperature of the target area:

Tavg = (Tmotor + Tbackground) ÷ 2

Solving for Tavg, we get (200 + 75) ÷ 2 or 137.5°F., which is what the CIH20DL would display. In other words, trying to measure the temperature of the motor from 24 ft. away introduced an error of (200-137.5) ÷ 200, or 31% into the measurement. In this case, the measured temperature was 31% below the motor's actual temperature because the background is cooler than the motor.

To eliminate measurement error, the CIH20DL must be moved close enough so the motor is the only object in the target area of its IRT (see below figure). For a motor with an area of 1 ft$^2$ and using an IRT with a D:S ratio of 8:1, the optimum measurement distance would be 8 ft.

For best results, the targeted area (spot) should fall within the target's boundaries
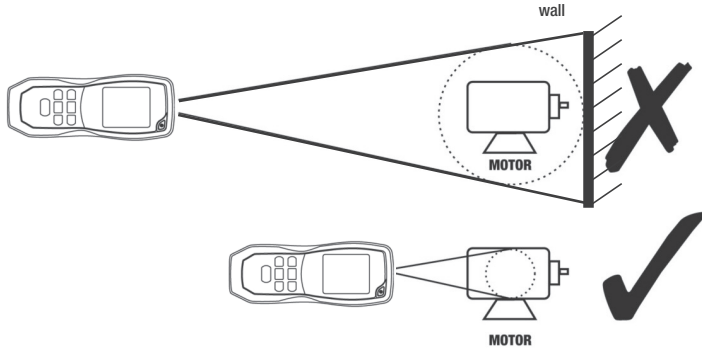


**Measuring a motor's temperature** from the wrong (top) and right (bottom) distance

## NOTES

# NOTES

**GENERAL®**

**Specialty Tools & Instruments**