



# **GT-2 Globe Temperature Sensor Manual**

57-6066 Rev A

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# I.0 NOTICES

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The information in this manual has been carefully checked and is believed to be accurate. However, Dyacon, Inc. assumes no responsibility for any inaccuracies that may be contained in this manual. All information is subject to change.

### Trademark Acknowledgments

Dyacon® and Dyacon® is a registered trademark of Dyacon, Inc.

Dyacon, GT-2™, GT™ are trademarks of Dyacon, Inc.

All other trademarks are property of their respective owners.

## 1.1.2 Manufacturer

Dyacon, Inc.

### 1.1.3 Declarations

Dyacon GT-2™ is a passive, low-voltage electrical device; it contains not frequency generating components.

#### RoHS

All electronic and mechanical components conform to RoHS, Directive 2002/95/EC.

#### FCC CFR Part 15

This equipment complies with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation.

### 1.1.4 Warranty Information

#### Limited Hardware Warranty

Dyacon, Inc. warrants that all Dyacon products and components shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment when installed according to instruction manuals accompanying said hardware and used for the purpose for which said hardware was designed. In the event a defect in materials or workmanship is discovered and reported to Dyacon within the warranty period, Dyacon will at its option repair the defect or replace the defective product. This warranty does not apply where the product has been operated outside the specifications of the product. Dyacon's obligation hereunder will be limited to such repair or replacement. Customers shall have the responsibility to ship the defective equipment to Dyacon at its (customer's) expense, with all cost of shipment prepaid. Dyacon will ship the repaired or replaced item at its (Dyacon's) expense using the preferred shipment method of Dyacon.

#### Disclaimer of Warranties

The warranties set forth above are in lieu of all other warranties of Dyacon, whether written, oral, or implied. Dyacon makes no warranties regarding its products (hardware or software), including without limitation warranties as to merchantability, fitness for a particular purpose, any warranty arising from course of performance, course of dealing or usage of trade whether any of the foregoing warranties are either expressed or implied. Dyacon specifically makes no warranties as to the suitability of its products for any particular application. Dyacon shall in no event be liable for performance, or use of any product covered by this agreement whether such claim is based upon warranty contract (express or implied), strict liability, negligence, or otherwise. Any responsibility and/or liability of Dyacon shall, in connection with a warranted product, be limited in maximum amount to the original purchase price of that product.

#### Removal of Serial Number

Removal of the original serial number label or reprogramming of the electronic serial number voids any warranty on the device. Dyacon will not repair or update products if the serial number label missing or legitimate ownership cannot be verified. Dyacon may not return equipment that is missing serial numbers or where legitimate ownership is in question.

#### Updates or Modifications

Dyacon shall be under no obligation to update or modify its products except as herein noted to correct defects or errors. Customer agrees that all representation and warranties contained herein shall be immediately null and void in the event of any incorrect installation, modification,

alteration, or change in or to any product affected by or on behalf of customer except for a change made by Dyacon or other direct supervision thereof.

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# 2.0 GT-2 INTRODUCTION

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## 2.1 Scope

The content of this document is intended for integrators, installers, and users of GT-2™.

This document includes installation instructions for connecting GT-2 to a Dyacon CM-1 weather station controller.

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## 2.2 Technical Support

### 2.2.1 Contact Information

Dyacon, Inc.

Phone: (435) 753-1002

Email: support@dyacon.com

Internet: www.Dyacon.com

Normal business hours are from 9:00 am to 5:00 pm. (Mountain Time Zone, GMT -0700)

### 2.2.2 Phone / Email Support

If you need technical support via the phone or email, please have the following information ready:

Product name, model number, and serial number.

Your name and name of the purchaser of the equipment.

Name of company, institution, or agency.

Phone number, email address.

Billing and Shipping address.

A clear description of the question or problem.

# 3.0 PRODUCT OVERVIEW

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## 3.1 Product Description

Dyacon GT-2™ is an integrated air sensor, measuring air temperature and incident thermal radiation. The sensor is intended to be used as a component of Dyacon weather station, or integrated into other automated equipment.

GT-2 is a thermistor device; it integrated a Dyacon TSSP-1. Globe temperature is determined by measuring the resistance of the internal thermistor with respect to a known external resistance.

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For specific information regarding the thermistor characteristics, please refer to Dyacon TSSP-1 Manual.

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GT-2 is easily mounted to the end of a 1” pipe using simple tools and standard structural pipe fittings.

### Mechanical Design

The mechanical design for GT-2 was designed to meet the following objectives.

- Minimize installation hardware and complexity – The sensor may be slipped over a 3/4” pipe or used with standard 1” structural pipe fittings.
- Minimize cable routing vulnerability – The cable can be routed directly adjacent to or inside of the mounting pipe.
- Maintain mechanical simplicity – The system can be easily disassembled and repaired in the field.
- Provide – A full copper sphere is used to provide intended thermal characteristics of a globe temperature sensor.
- Polyester Coating – The black coating provides maximum protection when mounted permanently out of doors.



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## 3.2 What Do You Get?

GT-2 ships with:

Globe assembly, mounting pipe, and cable ties.



*Image 3.1: Mounted showing mounting pipe.*

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## 3.3 What You Need

In order to utilize the GT-2 you will need the following.

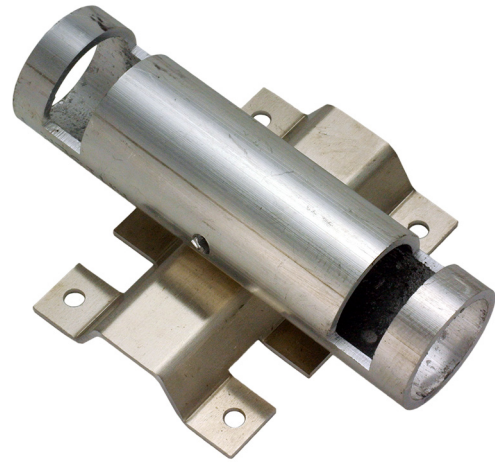
1" diameter mounting pipe (aluminum, steel, or PVC, 1.32 inch actual outer diameter).

Dyacon CM-1 weather station controller or data logger with an analog input and reference voltage.

## 3.4 Accessories

GT-2 is typically mounted to a Dyacon weather station cross arm using Dyacon crossover, XOVR-2.

Dyacon Crossover can be used for both pipe and flat surface mounting.



Standard structural pipe fittings for 1" schedule 40 pipe are available from hardware suppliers and manufacturers.

Hollaender Nu-Rail ([www.nurail.com](http://www.nurail.com))

J.C. Denier ([www.denierco.com](http://www.denierco.com))

Easyfit ([www.easyfit.com](http://www.easyfit.com))

Diamond Aluminum ([www.diamond-aluminum.com](http://www.diamond-aluminum.com))

KEE Systems ([www.keesystems.com](http://www.keesystems.com))

McMaster-Carr ([www.mcmaster.com](http://www.mcmaster.com))

Grainger ([www.grainger.com](http://www.grainger.com))



# 4.0 ASSEMBLY INSTRUCTIONS

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## 4.1 Required Tools

5/16" or 8 mm socket or slotted driver for the band clamps.

Small slotted driver for terminal block screws. (Included with Dyacon weather stations.)

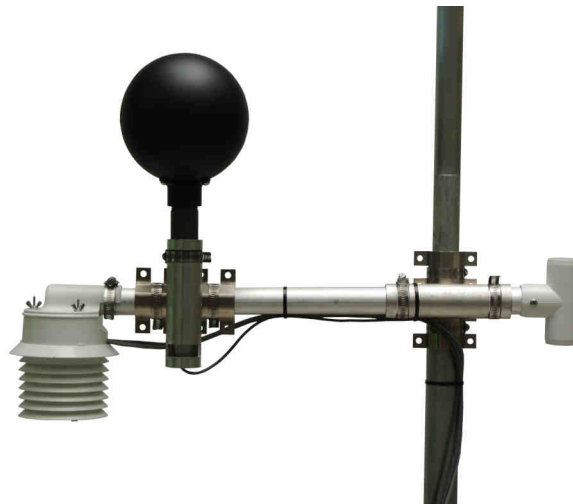
Other tools may be required depending on the installation.

## 4.2 Mounting

GT-1 mounting fitting uses 1" NPT pipe thread.

The supplied PVC pipe can be easily drilled to route the cable through the side of the pipe if necessary.

Observe wire route to avoid cutting or pinching the cable when mounting.



*Image 4.1: Typical GT-2 installation Dyacon Weather station.*

# 5.0 CONTROL MODULE CM-1 CONFIGURATION

## 5.1 GT-2 Wiring

TSSP-1 is a two-lead component. Each lead connects to opposing sides of the thermistor element. TSSP-1 does not contain a series resistor.

Wires should be **stripped to about 7 mm (0.25 inch)**.

White IN

Black GND

The component is not polarized and wire order is not critical.

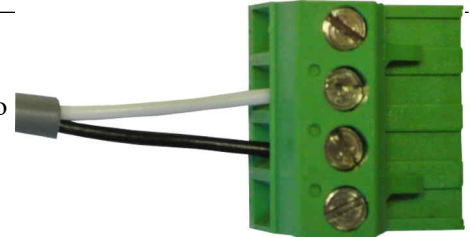


Image 5.1: TSSP-1 Wire Connection

## 5.2 Control Module Configuration

The analog port may be configured using the LCD, SMS text message commands, or using Dyacon Control Module Utility, a Windows PC program.

These are described in detail in the CM-1 manual and only the LCD configuration will be included here.

### 5.2.1 Analog Port Sensor Type Selection

The configuration options for the analog ports are dependent on the type of sensor selected. The following sensor type options are available:

None (Analog port measurements are not reported.)

Solar Radiation (PSP-110)

Soil Moisture (SMEC-5)

Soil Temp (TSSP-1)

Globe Temperature (GT-1)

Custom (User configures all parameters.)

Enter Analog port configuration by pressing **Select**

```
>Setup Analog 1
Type: None
```

Press ▲ (Up) and ▼ (Down) to show the desired sensor type.

```
Set Analog 1 Type
None
```

Press **Select** when the Globe Temp is displayed.

```
Set Analog 1 Type
Soil Temp
```

This will save the sensor type and page to the specific sensor settings.

The measurement units may be set as C or F (Celsius or Fahrenheit). The A, B, C, and D parameters of the Steinhart-Hart equation may also be individually set.

```
>Type: Globe Temp
Units: C
```

Use ▼ (Down) to select Units if the default units are not desired.

```
>Units: C
A: 01001116
```

Press **Select** to edit the temperature units, using the ▲ (Up) and ▼ (Down) buttons to display either C or F.

```
Set Temp Units
F
```

Press **Select** to save and exit.

```
>Units: F
A: 01001116
```

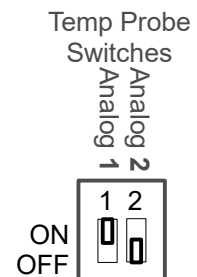
## 5.2.2 Series Resistor Switch

The switch corresponding to the analog port must be enable for the thermistor sensor. Please use the diagram as a guide.

The *Illustration 1* shows that Analog 2 is selected for TSSP-1.

The switch must be turned off when other sensors are used.

This switch is located on the lower connector row, near the Analog 2 connector.



*Illustration 1: Thermistor Series Resistor Switches*

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## 5.3 SMS Heat Stress Message

With GT-2 installed, users can request the heat stress SMS text message.

Send “H” to the weather station phone number (if it is equipped with an embedded cell phone). The following is an example of a heat stress message.

```
Heat Stress
Your Station Name
3:25 pm June 13 18
16.1% RH
WBGT: 21.6 C
Humidex: 29.9 C
Heat Index: None
```

# 6.0 WET-BULB GLOBE TEMPERATURE

Wet-bulb Globe Temperature (WBGT) is a relative scale that is associated with human body heat stress from ambient air temperature, humidity, radiant heat sources, such as the sun, and conducted heat transfer from air movement.

## 6.1.1 Web-bulb Globe Temperature Risk Categories

For military applications, the following categories correlate to the WBGT value.

Category	WBGT °F	WBGT °C	Flag color
1	≤ 79.9	≤ 26.6	White
2	80-84.9	26.7-29.3	Green
3	85-87.9	29.4-31.0	Yellow
4	88-89.9	31.1-32.1	Red
5	≥ 90	≥ 32.2	Black

(Army Technical Bulletin Medical 507 and Air Force Pamphlet 48-152(I) 7 March 2003)

Sports, industrial safety, and other safety organizations may utilize different values and specify different actions for the heat stress level.

## 6.1.2 Wet-bulb Calculation

The following formula is used to calculate WBGT for outdoor and indoor environments where there is a significant radiant heat source.

Either Celsius or Fahrenheit values may be used. However, the corresponding heat category values must match the temperature units.

$$\text{WBGT} = 0.7T_{\text{wet-bulb}} + 0.2T_{\text{globe-temp}} + 0.1T_{\text{dry-bulb}}$$

Wet-bulb temperature must be determined by using the dry air temperature and relative humidity measurements from Dyacon TPH-1 sensor. At a pressure of 1006 mbar, the follow formula will have a maximum error of 6%.

Temperature is in Celsius degrees.

$$T_{\text{wet-bulb}} = A * T_{\text{dry}} + B * rh + C * T_{\text{dry}}^2 + D * rh^2 + E * T_{\text{dry}} * rh + F$$

where:

$$A = 0.53913$$

$$B = 0.10478$$

$$C = -0.00074936$$

$$D = -0.0010774$$

$$E = 0.0064146$$

$$F = -5.1515$$

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# 7.0 REPAIR AND SERVICE

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## 7.1 Repair and Calibration

### Return Authorization

All equipment sent to Dyacon for calibration, warranty, or service should have a return material authorization (RMA) number indicated on the outside of the package. Include a detailed description of the problem and any to be performed on the returned unit.

An RMA number may be requested by phone or email.

Phone: 435-753-1002

Email: [support@Dyacon.com](mailto:support@Dyacon.com)

Normal business hours are 9 am to 5 pm. (Mountain Time Zone, GMT -0700)



## 8.0 REVISION HISTORY

<b>Rev</b>	<b>Description</b>	<b>Author</b>	<b>Date</b>
A	Initial Release	E. Bodrero	13 Jun 2018