

Product Guide

Digital Pressure Temperature Sensor (DPTS)

Revision 1.0

This manual is applicable to the following DPTS model numbers:

- DPTS-G1.3b-BAAAXXX
- DPTS-G1.5a-BAAAXXX



DunAn Microstaq, Inc.
4120 Freidrich Lane, Suite 225
Austin, Texas 78744 United States
(512) 628-2890
www.dmq-us.com

Published: Apr 2022
©2022

Table of Contents

1	Before You Begin	1
1.1	General Precautions.....	1
1.2	Document Conventions	1
1.3	Acronyms	1
1.4	About the DPTS.....	2
2	Mechanical Installation	3
3	Electrical Wiring	5
4	Modbus Memory Map for Communication	6
4.1	READ ME TO START	6
4.2	Memory Map table	7
5	Appendix	8
5.1	Scaled Format A	8
5.2	Scaled Format B	8
5.3	Notification codes	9
5.4	System states	9
5.5	Refrigerant List.....	9
5.6	Serial Number	10
5.7	Firmware Version.....	10

1 Before You Begin

1.1 General Precautions



Observe the following precautions when working with a DPTS:

- **Power:** Input power must be Class 2 rated or better. The DC power supply used for DPTS should not be shared with any other device.
- **Grounding:** Can be either ungrounded or can use a single-point ground. Multi-point grounds will damage DPTS. This can easily happen accidentally if bare wires are left exposed or harness wires are too tightly clamped to tubing or chassis.
- **Communication:** An isolated Modbus master is strongly recommended. A non-isolated MODBUS master can be used when it is the only grounded device connected to DPTS, in which case, it serves as the single-point ground.
- **Installation:** Always ensure the power is OFF and the wiring harness cables are disconnected during installation or servicing.
- **Mounting:** Observe acceptable orientations shown in **Section 2** and torque pressure port to 70 in-lbs.
- **Probing:** Never probe the harness pins; the pins are easily damaged if probed.
- **Static Electricity:** Always take anti-static precautions when handling the DPTS.
- **EMI:** Route DPTS wiring away from strong magnetic or (high voltage) electric fields.

1.2 Document Conventions

The following table shows a list of symbols found in this document and their descriptions.

Table 1-1 Descriptions of Symbols in the Document

Symbol	Description
	<i>WARNINGS</i> indicate that the action you are taking could either cause injury to yourself or could harm your products and systems.
	<i>IMPORTANT NOTES</i> appear in the text to indicate additional information that should be noted.

1.3 Acronyms

The following table shows a list of acronyms used in this document.

Table 1-2 Acronyms and Abbreviations in the Document

Acronym	Description
DPTS	Digital Pressure Temperature Sensor
MEMS	Micro Electro Mechanical Systems
AC / DC	Alternating Current / Direct Current

1.4 About the DPTS

The **Digital Pressure Temperature Sensor (DPTS)**, shown in **Figure 1-1**, is used to measure and report temperature, pressure, and superheat values. It consists of an internal MEMS pressure sensor and a processing unit. It uses a wiring harness, shown in **Figure 1-2**, which consists of thermistor to measure the temperature, RS485 communication wires, Power input wires, PWM output wires, and general-purpose wires which can be used to measure second temperature. The DPTS is installed on ¼" SAE 45° flare male fitting and utilizes the Modbus RTU protocol for communication.

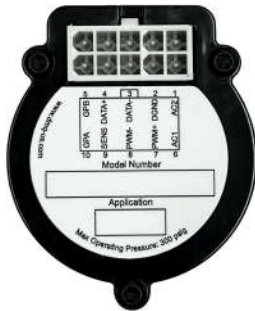


Figure 1-1 DPTS



Figure 1-2 DPTS Wiring Harness

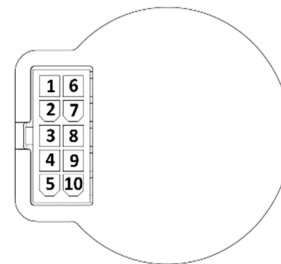
The DPTS and its wiring harness pin assignments are shown in **Table 1-3**.

Table 1-3 DPTS and Wiring Harness Pin Assignments

Pin Number	Pin Name	Pin Function	Wiring Harness Model (Type of Wire)	
			WH-DPTS-AX	WHUA-B1A11-A
Pin 1	AC2	Power Input	Red, 18 AWG	Red, 18 AWG
Pin 6	AC1	Power Input	Black, 18 AWG	Black, 18 AWG
Pin 3	DATA-	RS485- Communication	Black, 24 AWG, Shielded	Blue, 22 AWG, Shielded
Pin 4	DATA+	RS485+ Communication	Red, 24 AWG, Shielded	Orange, 22 AWG, Shielded
Pin 2	DGND	Digital Signal Ground and Thermistor Signal Ground	Green, 22 AWG	Green, 22 AWG
Pin 9	SENS	Thermistor Power	Black, 24 AWG	Black, 24 AWG
Pin 7	PWM+	PWM Output	White, 18 AWG	White, 18 AWG
Pin 8	PWM-	PWM Output	White, 18 AWG	Gray, 18 AWG
Pin 5	GPB	General Purpose – Not Utilized	Brown, 20 AWG	Brown, 20 AWG
Pin 10	GPA	General Purpose – Not Utilized	Purple, 20 AWG	Purple, 20 AWG

DPTS Series Model Numbers

- DPTS-G1.3b-BAAAXXX
- DPTS-G1.5a-BAAAXXX



2 Mechanical Installation



Do NOT turn the power source ON until installation of DPTS and wiring harness is complete. For the user's own safety, only Class 2 power source should be used to power the DPTS device.

1. Obtain a ¼" SAE 45° male flare fitting.
2. When installing the DPTS horizontally as shown in **Figure 2-1**, the DPTS can only be installed up to a 45° angle from the vertical axis in either direction (represented by the curved green arrows). When installing the device on a vertically, the DPTS cannot be installed at a downward angle (represented by the red arrow).

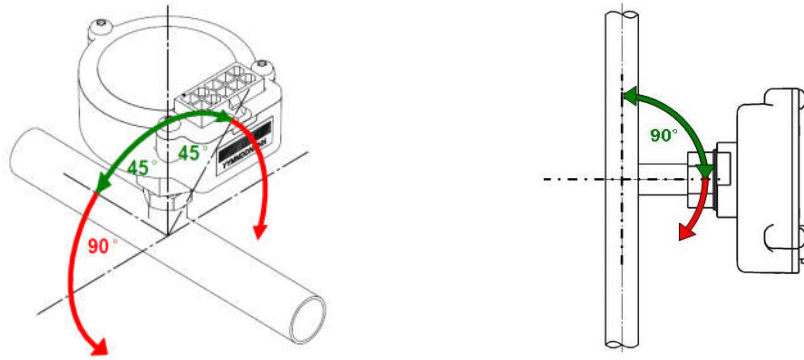


Figure 2-1 DPTS installation orientation on horizontal and a vertical tube

3. Mount the DPTS onto the SAE male flare fitting. First, turn the DPTS clockwise by hand until some resistance is observed. Then, use a torque wrench to tighten the DPTS to **70 in-lb** as shown in **Figure 2-2**.

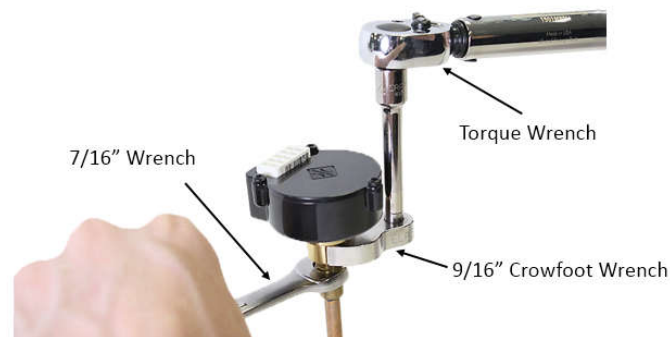


Figure 2-2 DPTS Installation with Torque Wrench (70 in-lb)

4. Attach the wiring harness (10-pin connector) to the DPTS.



If the DPTS is located in a wet or potentially wet environment, apply dielectric or super lube synthetic grease inside the 10-pin connector of the wiring harness.

5. The thermistor can be placed anywhere the end user sees fit for their application. When thermistor is placed where there will be moisture, apply synthetic grease where wires join the thermistor shell. **Figure 2-3** shows thermistor being installed on a copper tube with a zip tie. The thermistor should be located at either the 10 o'clock or 2 o'clock position only for superheat measurements for HVAC-R applications.

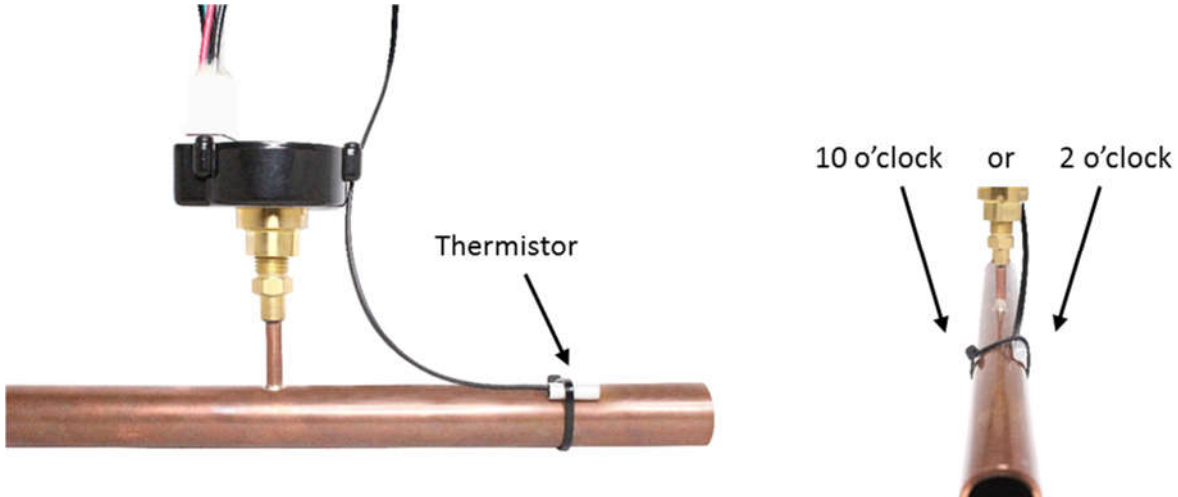


Figure 2-3 Thermistor installation



Ensure that the thermistor wire is not tied down to the tubing. The zip tie should only be tied around the thermistor body.



Apply thermal grease between the thermistor and the copper line to obtain the most accurate temperature readings.

6. Wrap the thermistor with the insulation material and secure the insulation in place using a zip tie. The final result should be similar to what is shown below **Figure 2-4**.

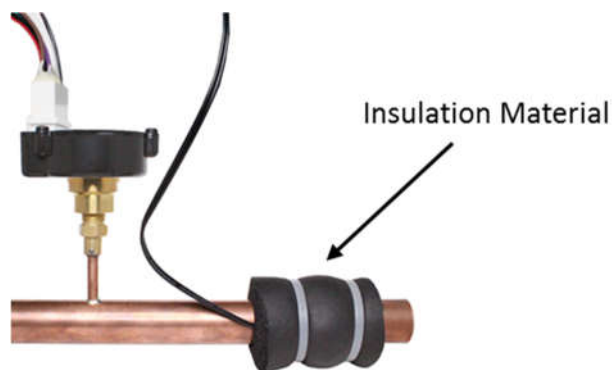


Figure 2-4 Insulation secured to the thermistor

7. The mechanical installation of DPTS is now complete.

3 Electrical Wiring



Do NOT turn the power source ON until all electrical wiring setup is complete.



Contact DMQ for instructions to network multiple DPTS devices.

1. Obtain a 12 VDC or 24 VDC output **Class 2** power supply with a 40 to 100 W power rating.
2. Double check the power source output voltage. When using 24VDC for 24V device control, the voltage must be within the range of 24VDC to 27.6VDC. When supplying 12VDC for 12V device control, the voltage must be within the range of 12VDC to 13.8VDC. Once the power source output voltage has been identified and checked to be accurate, ensure that the power supply is OFF before continuing with the steps below.
3. The power input wires (18 AWG red/black wires) on the wiring harness should be connected to the power source as shown below in **Figure 3-1**.



The DPTS power input wires do not have polarity, so the wire ordering and colors are not significant for the purposes of this step in the procedure.

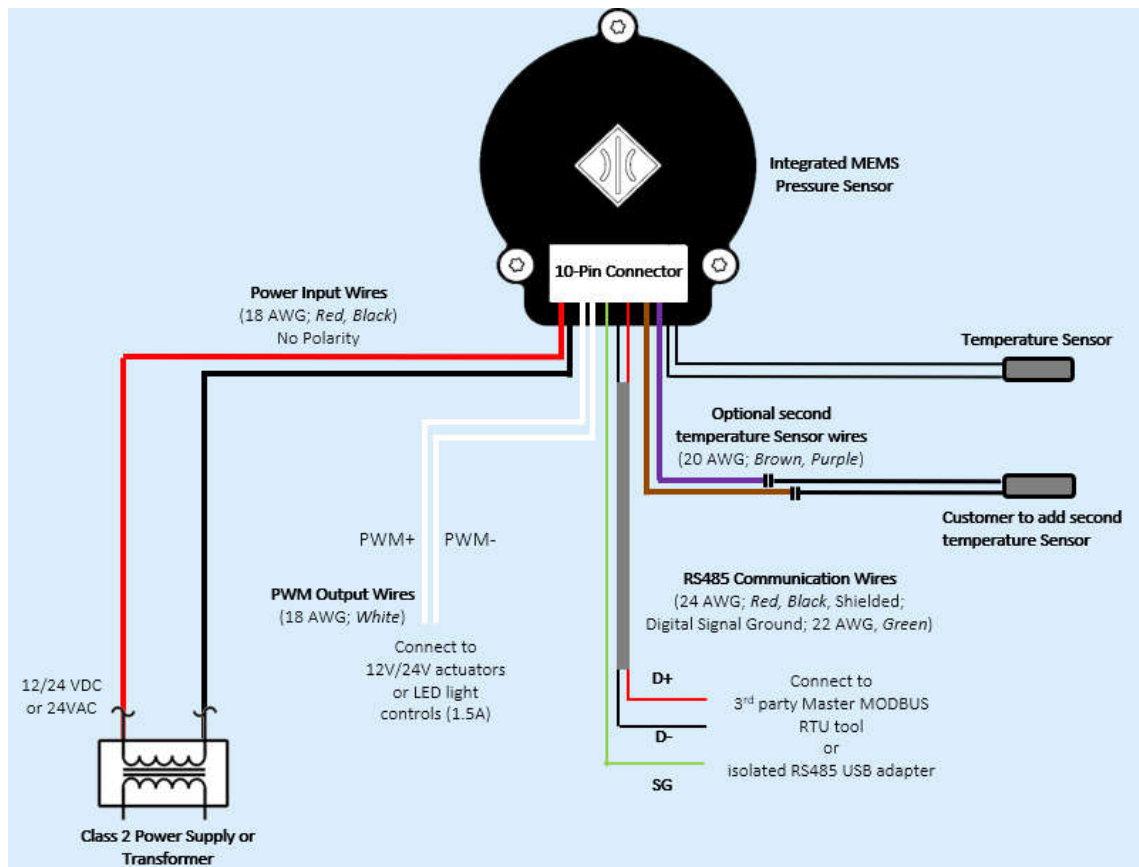


Figure 3-1: DPTS wiring diagram using WH-USHX-AX wiring harness

4. Connect the RS485 communication wires (2-wire gray cord that contains a red and a black wire and the green data ground wire) to the D+, D-, and SG terminals of Master MODBUS RTU tool.
5. When used just as a sensor, PWM output wires (two 18 AWG white wires) are not required and should be terminated. Connect the white PWM output wires to the actuators or LED light controls when there is a use. These wires are non-polar.
6. The general-purpose wires (20 AWG brown/purple wires) can be used for a second temperature sensor. They should be terminated when not used.
7. Tape any dangling wires to existing structures, such as copper and water lines, with at least 4-5 sections of electrical tape each. Use zip ties on top of the electrical tape in a neat and organized manner to further secure the wires.



Ensure that all cables are distanced from fans, high voltage wires (120-208 VAC), and potential areas of water. Ensure that any bare cable leads are covered with electrical tape and do not touch other wire leads or any metal structures.

8. The electrical wiring for DPTS is now complete.

4 Modbus Memory Map for Communication



Contact DMQ if end user would prefer to use Windows based Graphical User Interface

4.1 READ ME TO START

- **This section assumes that the user is familiar with all the relevant terminology.**
- Software communicates through RS-485 only.
- Function codes supported: Read Registers (0x3), Write single register (0x6) and Write Multiple-registers (0x10).
- Data Type: All data is stored as a signed 16-bit integer. High-order byte is sent first.
- Scaling: In some instances, the data is scaled to handle various formats. Please read the “Remarks” Column, to know about how the data is formatted for both sending and receiving data. There are two scaling formats and both are detailed in the Appendix.
- Software works ONLY at 9600, 19200 baud with 8bits, 1 stop bit, and no parity and even parity.
- Device-ID configuration is a two-step process. First, the register (40068), data-address 67 needs to set with the correct value to let the DPTS know that device-ID can be modified. Once the DPTS gets notification that device-ID can be updated, register (40073) can be updated with the preferred device-ID value. DPTS will automatically disable the ability to modify device-ID after the modification is complete. All DPTS devices have a starting factory default ID of 1.
- Software assumes that device-ID configuration is done individually before networking the multiple devices.
- Software supports a unique Serial Number for all DPTS devices which resides at data address 69-71 in the map.

- Software reports data in units of kilopascal and Celsius for pressure and temperature, respectively. It is the responsibility of the client software to convert the units if necessary.
- Software provides a unique ID at Register 40067 to discover DPTS devices. This is useful when there are other non-DMQ Modbus devices in the network and the Master wants to discover DMQ DPTS devices.
- In a single or networked environment (talking to multiple DPTS devices through Modbus RTU), the MASTER needs to consider two timers
 - **Wait between commands:** Time to wait after MASTER gets a valid response from the DPTS before sending the next request.
 - **Timeout:** Time to wait if MASTER does not get a response or gets an invalid response from the DPTS.

It is recommended to use one of the following settings.

Timer setting options	Wait between commands (ms)	Timeout (ms)	Retries
A	100	350	2
B	100	200	3

- Firmware limits a Modbus read function to 10 contiguous registers for every second.

4.2 Memory Map table



The registers not mentioned in below table are either not applicable to DPTS and/or reserved for DMQ internal use.

Name	Register	Data Address	Attribute	Remarks
Measured Pressure	40001	0	Read-only	<ul style="list-style-type: none"> • Data stored in absolute pressure (kPa units) in firmware. • Value range (101.3 to 1825). • Refer to section “Scaled Format A” in Appendix.
Measured Temperature	40002	1	Read-only	<ul style="list-style-type: none"> • Data stored in Celsius in firmware. • Value range (-42 to 105). • Refer to section “Scaled Format B” in Appendix.
Calculated Superheat	40003	2	Read-only	<ul style="list-style-type: none"> • Data stored in Celsius in firmware. • Refer to section “Scaled Format B” in Appendix.
System Notifications	40004	3	Read-only	Refer to section “Notification codes” in Appendix.
Power Source	40005	4	Read-only	0 = 24V DC 1 = 24V AC 2 = 12V DC
System State	40008	7	Read-only	Refer to section “System States” in Appendix.
Measured External Temperature	40009	8	Read-only	<ul style="list-style-type: none"> • Data stored in Celsius in firmware. • Value range (-42 to 105). • Refer to section “Scaled Format B” in Appendix.
Refrigerant	40033	32	Read-write	Refer to section “Refrigerant List” in Appendix.
PWM Frequency	40034	33	Read-write	• Value range (1 to 120) Hz.
PWM	40042	41	Write-only	<ul style="list-style-type: none"> • Any read values are invalid. • Refer to section “Scaled Format B” in Appendix. • Value range (2 – 95) %

DPTS-Specific-ID	40067	66	Read-only	6877 A unique ID to discover DMQ DPTS devices. This is useful when there are other non-DMQ Modbus devices in the network.
Device-ID Permission	40068	67	Read-write	9001 = Enable the firmware to modify device-ID. 6001 = Disable the firmware to modify device-ID.
External Temperature Sensor Indicator	40069	68	Read-only	1 = External temperature sensor NOT activated. 2 = External temperature sensor activated.
Serial number	40070 - 40072	69-71	Read-only	<ul style="list-style-type: none"> Total ID is 5 bytes. Refer to section 'Serial Number' in Appendix
Device-ID	40073	72	Read-write	Assign a simplified unique node number for the operation. (0 is broadcast. Valid numbers are from 1 to 247). Firmware does NOT currently support broadcast messages.
Hardware version	40083	82	Read-only	Refer to section "Scaled Format A" in Appendix.
Firmware COM Port Setting	40084	83	Read-write	0 = 9600, no parity 1 = 9600, even parity 2 = 19200, no parity 3 = 19200, even parity
Firmware Version	40088 – 40090	87-89	Read-only	Refer to section 'Firmware Version' in Appendix

5 Appendix

5.1 Scaled Format A

- Supports accuracy of 1 decimal point.
- Data written to the 16-bit register needs to be (actual data * 10).
- Master -> DPTS: Master will need to multiply data with 10 and send over the wire to the DPTS.

Example for Scaled Format A:

- Goal: Retrieve data from data-address location 0 and use "Scaled Format A" to display correct value.
- Master sending a read request to device-ID 2 at register 40001, data address 0.
- DPTS responds "03 F5" which is 1013. According to "Scaled Format A" note above, the actual value is 1013/10 = 101.3

```
(Master->DPTS) >>> 02 03 00 00 00 01 84 39
(Master<-DPTS) < 02 03 02 03 F5 3C F3
```

5.2 Scaled Format B

- Supports accuracy of 2 decimal points.
- Data written to the 16-bit register needs to be (actual data * 100).
- Master -> DPTS: Master will need to multiply data with 100 and send over the wire to the DPTS.

Example for Scaled Format B:

- Goal: Retrieve data from data-address location 1 and use "Scaled Format B" to display correct value.
- Master sending a read request to device-ID 2 at register 40002, data address 1.
- DPTS responds "0A 30" which is 2608. According to "Scaled Format B" note above, the actual value is 2608/100 = 26.08

```
(Master -> DPTS) >>> 02 03 00 01 00 01 D5 F9
(Master <- DPTS) < 02 03 02 0A 30 FA F0
```

5.3 Notification codes

NO ERROR	(0x0000)
HIGH voltage	(0x0004)
Measured second temperature sensor out of range	(0x0008)
Pressure sensor out of range	(0x0010)
Internal temperature sensor out of range	(0x0020)
Measured temperature sensor out of range	(0x0040)
High temperature difference between internal and measured temperature	(0x0080)
Low voltage	(0x0800)

5.4 System states

Operating mode	0/1
Fixed PWM mode	2
Safety mode	6

5.5 Refrigerant List

R410A	1
R404A	2
R407A	3
R134A	4
R22	6
R407C	7
R407F	8
R417A	9
R422A	10
R422D	11
R427A	12
R438A	13
R448A	14
R449A	15
R450A	16
R507A	17
R513A	18
R452A	22



Contact DMQ for any other refrigerant requirements

5.6 Serial Number

Registers 40070-40072

Register	Response Bytes (Hex)	High Byte / Low Byte	Convert Hex to Dec
40070	0010	00	00
		10	16
40071	0B1C	0B	11
		1C	28
40072	0454	04	04
		54	84

DMQ Serial Number scheme: 40070(Low) 40071(High) 40071(Low) 40072(High) 40072(Low)

5.7 Firmware Version

Registers 40088-40090

Register	Response Bytes (Hex)	High Byte / Low Byte	Convert Hex to Dec
40088	1612	16	22
		12	18
40089	5224	52	82
		24	36
40090	0008	00	00
		08	08

DMQ Firmware versioning scheme: 40088(High).40088(Low).40089(High).40089(Low).40090(Low)