Johnson Matthey

380 Lapp Road
Malvern, PA 19355
1-800-RX FOR AIR
[1-800-793-6724]
FAX: 1-610-971-3116
e-mail: info@jmusa.com
www.jmcsd.com

a b c d

Catalysts

Form Title: G3 CRTdm Diagnostic Module	Author: Todd Jacobs
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Johnson Matthey CRT CONTINUOUSLY REGENERATING TECHNOLOGY

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Johnson Matthey CCRT CATALYZED CONTINUOUSLY REGENERATING TECHNOLOGY

CRTdm Diagnostic Module
Installation And Operation Manual

Part Number: 10060

Table Of Contents

Warranty Claim Procedure

Johnson Matthey warrants the CRTdm under the **LIMITED WARRANTY POLICY** shown on the previous page. Please use the following procedure when filing a claim.

- All warranty claims must be made in writing within 60 days from the date of the initial incident.

- All claims must be filed through Johnson Matthey and all warranty work must be performed by Johnson Matthey or a JM authorized distributor.

☑ **NOTE:** The **RECORD OF INSTALLATION FORM** provided in the CRT / CCRT or CRTdm kit ***MUST*** be completed for each CRT / CCRT particulate filter installed. This form must be on file with Johnson Matthey to validate the product warranty.

Be sure to record the information from the CRTdm (serial no.) to validate the product warranty.

CRTdm Module Limited Product Warranty

WARRANTY

A) The Johnson Matthey CRT® dm module, included in the CRTdm, is warranted as below, provided the CRTdm module is installed and operated by Buyer in accordance with the installation instructions. If these conditions are not met, the CRTdm module warranty will be voided.

B) Subject to the conditions set forth in paragraph A) above, Johnson Matthey Inc.'s (JMI) warrants the CRTdm module, except as otherwise expressly described in the JMI proposal for sale of this CRTdm, which is covered by the manufacturer's parts and workmanship warranty for a period of one year from the date of installation of the CRTdm. The remainder of the items provided with the CRTdm module are covered by the manufacturer's parts and workmanship for a period of 30 days from installation of the CRTdm.

C) Recommendations by JMI, if any, concerning the use, utilization, properties or qualities of CRTdm delivered hereunder are believed reliable, but JMI makes no warranty whatever with respect thereto except as provided in B above. Use or application of the CRTdm sold by JMI to Buyer hereunder is at the discretion of the Buyer without any liability or obligations on the part of JMI except as expressly warranted by JMI in B above.

D) THIS IS THE SOLE AND EXCLUSIVE WARRANTY PROVIDED BY JMI WITH RESPECT TO THE CRTdm MODULE AND THE CRTdm INSTALLATION KIT. JMI MAKES NO OTHER WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FURTHER, THE LIMITED WARRANTY SET FORTH DOES NOT APPLY TO THE RESULTS OF ACCIDENT, ABUSE, NEGLECT, VANDALISM, ACT OF GOD, USE CONTRARY TO JMI'S INSTRUCTIONS, IMPROPER INSTALLATION, REPAIR, REPLACEMENT OR MODIFICATION BY ANYONE OTHER THAN JMI (EXCEPT WITH JMI'S WRITTEN APPROVAL). JMI does not warrant against infringement by reason of the use of such CRTdm by Buyer in combination with other materials or in the operations of any process. JMI SHALL NOT BE LIABLE FOR LOSS OF PROFITS, INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR OTHER DAMAGES ARISING OUT OF OR RESULTING IN ANY WAY FROM ANY CRTdm OR FROM ANY CAUSE WHATSOEVER, REGARDLESS WHETHER BUYER'S CLAIM IS BASED ON, WITHOUT LIMITATION, CONTRACT, TORT, NEGLIGENCE, PRODUCTS LIABILITY, OR ANY OTHER CAUSE. JMI's total, complete and exclusive liability hereunder shall be limited to repair or replacement of the CRTdm module, or refunding such payments made for such CRTdm module, as provided in Section 2 below.

LIMITATION OF REMEDIES

A) JMI's liability for breach of warranty shall be limited to, at its option, either (1) repairing or replacing such CRTdm module, or (2) refunding the payments made for such CRTdm.

B) Any claim under this warranty must be in writing and received by JMI within sixty (60) days of the date that the instance giving rise to a claim is first known.

Johnson Matthey CRTdm

Thank you for choosing the Johnson Matthey CRTdm (CRT diagnostic module). The CRTdm is a device designed to continuously monitor the Johnson Matthey CRT® / CCRT® system. The CRTdm provides critical information to the vehicle operator and maintenance staff relative to operation and performance of the CRT / CCRT diesel particulate filter.

What's Inside?

Included in this Users Manual is a CRTdm and installation kit parts list, a description of the CRTdm, general guidelines for proper installation of the CRTdm and operational instructions.

Please read each section carefully before installing and operating your CRTdm.

Look for this ☑ symbol. It is intended to highlight important items regarding the installation of your CRTdm.

The information provided in this manual is general in nature, if you have questions for your specific installation, please contact Johnson Matthey or your distributor/dealer.

☑ **NOTE:** Federal and CARB verifications require that every vehicle fitted with a diesel particulate filter must install and operate a backpressure monitoring device such as the CRTdm. Contact Johnson Matthey or your dealer/distributor if you have questions regarding your specific requirements.

Warranty and Record of Installation

The statement of warranty for the CRTdm can be found at the end of this Users Manual. The Record of Installation for the CRTdm is part of the Record of Installation for the CRT system.

The **RECORD OF INSTALLATION FORM** provided in the CRT / CCRT or CRTdm kit ***MUST*** be completed for each CRT / CCRT particulate filter installed. This form must be on file with Johnson Matthey to validate the product warranty.

Be sure to record the information from the CRTdm (serial no.) to validate the product warranty.

CRTdm and Parts Kit

CRTdm

The package containing the CRTdm includes the following:

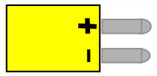
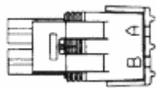
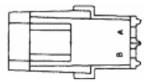
Part Number	Description	Qty.	Picture
10045	CRTdm Module – Weather resistant	1	
Parts Kit			
9293	Male Thermocouple Connector	1	
9295	Tower half (male), Weather-Pack Connector	1	
9296	Shroud half (female), Weather-Pack Connector	1	
9297	Silicon Weather-Pack Seal	4	
9299	Male Weather-Pack Terminal	2	
9302	Female Weather-Pack Terminal	2	
9304	Thermocouple w/ wire	1	
9310	Self Tapping Mounting Screws w/ washers	4	
10060	Users Manual	1	

Table 1: CRTdm Parts List

Pressure Transducer

Housing	Cylindrical machined 316 SS housing. Unit will be contained within the CRTdm.
Diaphragm	316L.
Operating Temp Range	-40° to 125°C.
Shock	100 G for 11mSec.
Vibration	10G at 20-2000 Hz.
Lifetime	1 million cycles.
Temp Compensated Range	-10° to 85°C.
FS Range	0 – 20” Hg (0-10 PSIG) suggested. 20 PSI Proof/ Max. As deployed in CRTdm, the useable pressure range is 0 to 20”Hg.
Accuracy	Typ: +/- 1.5%FS over temp; Max; +/-3%FS.
Pressure Connection	Via ¼” – 18 Male NPT directly onto integral pressure transducer.
Supply Power	Power will be supplied through the CRTdm module. The power supply will be pre-regulated and surge protected.

Temperature Sensor

Type	K thermocouple.
Package	1/8” dia x 8” long Inconel 600 insertion probe compatible with Swagelok type compression fitting. Ungrounded thermocouple in hi-temp magnesium oxide insulator with MGO cement cap. Provided with 20 ft electrically shielded teflon leads with 3 ft of spiral armor at probe end. Lead rated 260°C continuous. Probe tip rated 1000C continuous.
Temp Range (withstand)	-100° to 1000°C continuous.
Temp Range (operational)	0° to 1000°C
Sensor Accuracy	“Special Limits” TC wire used: +/- 1.1°C or +/-0.4%rdg whichever is greater over range 0° to 1000°C.

Specifications

CRTdm Electro-Mechanical

Housing	Metallic enclosure, near weatherproof seal, with sealing gland type fittings for wire egress.
Dimensions	10” x 6” x 3.5” with a tab/flange at each end for surface mounting.
Wiring Connections	Via Weather-Pack and Mini Type-K connectors on 3 separate pigtails. No user serviceable connectors are inside the enclosure.
Wiring Egress	Sealing gland type fittings. Sealed serial connection on electronics module cover.
Pressure Connection	Via ¼” – 18 Male NPT directly onto integral pressure transducer.
Ambient Operating Temperature	-30° to 85°C (-22° to 185°F)

CRTdm Electrical

Supply Voltage	Input range 12 to 24 Vdc.
Supply Current	50mA average current, 150mA max current including all sensor excitation.
Cold Junction Compensation	Integral via on board sensor at thermocouple connection point. CJC accuracy to add less than +/-1.5°C error over specified CRTdm ambient operating range; (typical will be less than +/-0.6°C)
ADC Resolution	10 bit unipolar; will result in apx 2°C resolution for temperature and 0.1” Hg for pressure.
ADC Accuracy	Max (over temp): +/- 4 bits%.
System Accuracy	Temperature Error Max: +/-5°C (typical +/-2°C). Pressure Error: +/-1.5% typical, 3% max.
Sample Capacity	The CRTdm is capable of storing approximately 260,000 records in internal memory. Dynamic allocation of memory space will be implemented to allow for asynchronous event storage (e.g. alarms).
RTC	Integral real-time clock with 10 year life expectancy lithium cell backup. Ambient temperature (25°C) accuracy of +/-30 seconds/ month.
Glitch Recovery	The CRTdm microprocessor will be equipped with a hardware watch dog timer to restore normal operation in the event of a system upset.
Alarm Outputs	Two outputs. Alarm 1 is an “open collector” transistor output. Alarm 2 is a relay output. The “normally closed” contacts of this relay are used to add a level of “fail-safe” integrity to the system in the event of a system power failure. The relay will short Terminal strip TS2, Position 4 to ground upon alarm condition or in the event of a power failure of the CRTdm.
Serial Data Port	Multi-wire serial interface for connection to a PC. A fixed baud rate of 115K/baud is supported.
Software Restart	Upon interruption and re-application of power, the CRTdm will commence normal operation including data logging and alarm functions.

CRTdm Installation Kit

Johnson Matthey offers an optional installation kit that includes the following:

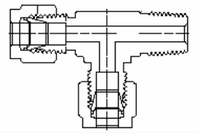
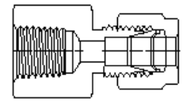
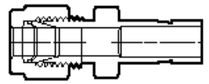
Part Number	Description	Qty	Picture
9183	Male Run Tee	1 ea	
9184	Female Connector Tube	1ea	
9185	Reducer Bored Thru	1 ea	
9176	1/4” OD Thick Wall Copper Tube	20ft	Roll
9181	White 14 AWG Wire	30ft	
9182	Red 14 AWG Wire	30ft	
9180	Green 18 AWG Wire	20ft	
9179	Blue 18 AWG Wire	20ft	
9177	Terminal (for ECM interface)	4 ea	
9246	3 amp ATO Fuse	1 ea	
9257	Fuse Holder for ATO style fuse	1 ea	
9261	Wire Loom	20ft	

Table 2: CRTdm Installation Kit Parts List

Some distributors have developed individual kits for various applications. Please contact your distributor if you desire a specific installation kit.

System Description

The CRTdm monitors exhaust temperature and backpressure of the CRT / CCRT system. It will warn the operator of the need for filter cleaning or if a potential exhaust system problem exists. The CRTdm is equipped with internal memory and datalogs temperature, backpressure and alarm events that occur during vehicle operation. Data is accumulated over time and can be downloaded via a serial link to a PC for further analysis. The CRTdm contains alarm outputs which can be either interfaced to the vehicle ECM to activate Check/Stop Engine lights or to a remote display. Contact your local distributor for complete details.

CRTdm Module

The CRTdm is ruggedly packaged and is capable of withstanding a wide temperature range. It is designed for retrofit into buses, trucks, and other industrial vehicles.

Exhaust temperature is monitored with a thermocouple probe installed in the CRT / CCRT inlet module. Exhaust backpressure is measured with a pressure sensor located within the CRTdm and connected to the CRT / CCRT inlet using an extension tube. The temperature and pressure data are collected on a continuous basis and monitored to detect conditions that exceed defined limits.

Figure 1 illustrates the externals of the CRTdm followed by a brief description of each component.

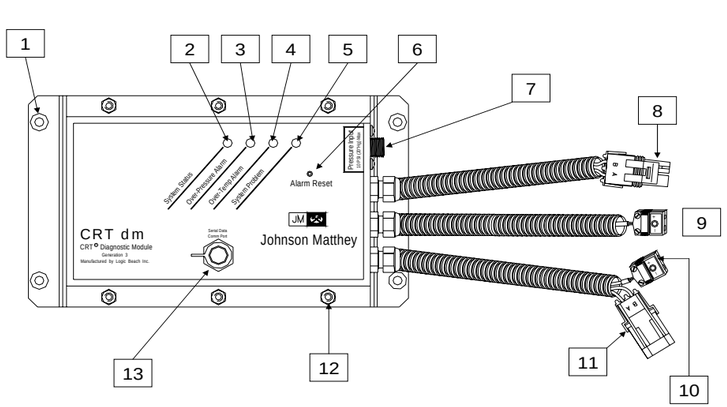


Figure 1: CRTdm Module

1. **Mounting Hole.** The four grommeted mounting holes are used to mount the unit in the vehicle with the self tapping screws and washers supplied with the CRTdm.
2. **System Status Light.** A flashing green LED that indicates system status.
3. **Over Pressure Alarm.** A red LED comes on when the user defined limit for a High Backpressure Alarm has been reached.
4. **Over Temperature Alarm.** A red LED comes on when the user defined limit for a High Temperature Alarm has been reached.

Basic CRTdm Alarm Diagnosis

Table 7 covers alarm diagnosis very basically. **It is not intended to be used to determine the cause of a CRTdm alarm.** The CRTdm Communications Software must be used in conjunction with the LED's to diagnose a CRTdm alarm. If you do not have the CRTdm Communications Software you must contact your distributor to assist in diagnosing CRTdm alarms.

LED Illuminated	Solution
1. The Green LED by "System Status" is not flashing.	The CRTdm has no power. If there was no noticeable loss of engine power the truck may be safely driven back to the maintenance yard.
2. Green LED is flashing and the Red LED by "System Problem" is on.	One or more of the sensors providing data to the CRTdm has malfunctioned. Alert maintenance. The truck can be safely driven back to the maintenance facility.
3. Green LED is flashing, Red LED by "Over-Temp" is on and the Red LED by "System Problem" is on.	The exhaust temperature probe has malfunctioned. Alert maintenance. The truck can be safely driven back to the maintenance facility.
4. Green LED is flashing and the Red "Over-Temp" LED is on (no "System Problem" LED).	The exhaust temperature is too high. Alert maintenance. The truck can be safely driven back to the maintenance facility.
5. Green LED flashing and the Red "Over-Pressure" LED is on.	The exhaust back-pressure has exceeded operational limits. **If the RED Over Pressure LED is on, or comes on while driving the truck, the truck MUST be taken to maintenance as soon as possible.**

Table 7: Alarm Diagnosis

☑ **NOTE:** Any alarm events must be investigated immediately. Failure to do so may result in severe damage to the CRT / CCRT or the engine. Failure to diagnose any alarm events may void the warranty on the CRT / CCRT or CRTdm.

Contact Information

For further information on installation, operation or troubleshooting contact:

Johnson Matthey Inc.
380 Lapp Road
Malvern, PA 19355
1-610-971-3100
Email: info@jmusa.com

Operation

The CRTdm comes pre-programmed from the factory with a default program. Once power is supplied to the CRTdm and the green status light is flashing no other operation is required.

☑ **NOTE:** In order to change the program in the unit, the operator must follow the instructions in the CRTdm Software Manual.

☑ **NOTE:** The four operational lights on the front of the CRTdm must be monitored for routine maintenance. See Table 6 and 7.

CRTdm Display LED

Status LEDs and information	
System Status	Will blink once every 2 seconds indicating adequate power supply and normal operation.
Over-Pressure Alarm	ON if back pressure exceeds set limits / OFF during normal operation
Over-Temperature Alarm	ON if exhaust temperature exceeds set limit / OFF during normal operation
System Problem	ON if the CRTdm detects a problem with a sensor / OFF during normal operation

Table 6: LED Information

5. **System Problem.** A red LED comes on whenever the CRTdm detects a problem with the pressure sensor or thermocouple.
6. **Alarm Reset Button.** Pressing this button will turn off any of the alarm lights (as long as the alarm conditions no longer exist).
7. **Pressure Sensor Connector.** Connection to the pressure sensor.
8. **Power Pigatil:** Power is supplied to the CRTdm through this connector.
9. **Outlet Thermocouple Connector:** This connector is used only if the CRTdm is being used with two thermocouples. If not in use, please leave the red cap on the connector.
10. **Inlet Thermocouple Connector:** This connector is **ALWAYS** used in all applications.
11. **Alarm Output Connector:** Alarm signal is transmitted through this connector to the engine ECU or a remote mounted display.
12. **Mounting Nuts:** Mounts the enclosure to the base
13. **Serial Data Comm Port:** A communications link is established through this connector to a PC or laptop computer (see below for more information).

CRTdm Communications Software

If your shop is equipped with a mobile PC or laptop computer running Windows 95 or newer, you will be able to access the data the CRTdm stores in memory.

The CRTdm software is a user friendly single screen program that operates under the Windows 95, 98 and 2000 operating systems. Once installed on a PC, the software allows communication between the PC and the CRTdm. You can develop CRTdm alarm programs, download data, graph the data, and diagnose CRTdm alarms. It is available on CD format and includes CRTdm Communications Manual, software CD, and interface cable that allows communications between the PC and the CRTdm.

Updates are also available via the internet at http://65.202.131.122:8080/. Here you will find the latest updates for the CRTdm Communications Software, additions to the Installation and Communications Manuals and the latest firmware. Please contact Johnson Matthey or your distributor for a user name and password.

This is a valuable tool that will aid in the diagnosis of CRTdm alarm events. With this software you will be able to determine time/date of an alarm, the back pressure and temperature at the time of the alarm, and what caused the alarm. The software can also be used to help diagnose problems not related to the CRT / CCRT or CRTdm (such as a plugged charge air cooler).

For complete details, consult your local distributor.

Installation Procedure

The CRTdm installation should be conducted in two parts; mechanical and electrical. Both sections of the installation are included in this manual.

☑ **NOTE:** The following CRTdm installation conditions must be met or the warranty will be voided.

The CRTdm must be mounted in a space where the ambient temperature is below 85°C (185F) under normal vehicle operation. The CRTdm must be located away from direct sources of heat such as the engine, exhaust manifolds and radiator.

The CRTdm must be mounted in a location where it is not directly exposed to high pressure steam cleaning, solvents, battery off-gas or electrical discharge.

The CRTdm must be connected to a 12 or 24 volt DC power supply.

The CRTdm must not be subjected to voltage supply or power surges greater than 30 volts DC.

The thermocouple and wire supplied with the CRTdm must be used with this unit. Use of any other thermocouple or wire must be approved by Johnson Matthey.

Johnson Matthey recommends that the CRTdm be mounted in a position higher than the CRT inlet. This will reduce clogging of the pressure sensor from water that collects in the tubing between the CRT / CCRT system and the pressure sensor.

☑ **NOTE:** Johnson Matthey requires that the CRTdm be installed at the same time as the CRT / CCRT system to validate the CRT / CCRT system and CRTdm warrantees.

Mechanical Installation

☑ **NOTE:** Prior to installation of the CRTdm, power must be turned off in the vehicle or the batteries must be disconnected.

Pre-Installation Preparation

- Select a location for the CRTdm that meets the above criteria. Use the four mounting holes on the CRTdm as a template to mark four (4) points and drill four (4) 9/32" holes. Attach the CRTdm using the self-tapping screws and washers supplied with in the CRTdm Kit.
- Every CRT / CCRT is fitted with a ¼ inch female NPT boss (Figure 2), that will accept the fittings identified in the CRTdm installation kit. Before any fittings are installed on the CRT / CCRT system, the location of the boss must be accessible so that the thermocouple can be easily inserted into the Tee fitting. If the boss is not accessible, the CRT / CCRT inlet head should be rotated until the boss is accessible.

Mechanical Installation Diagram

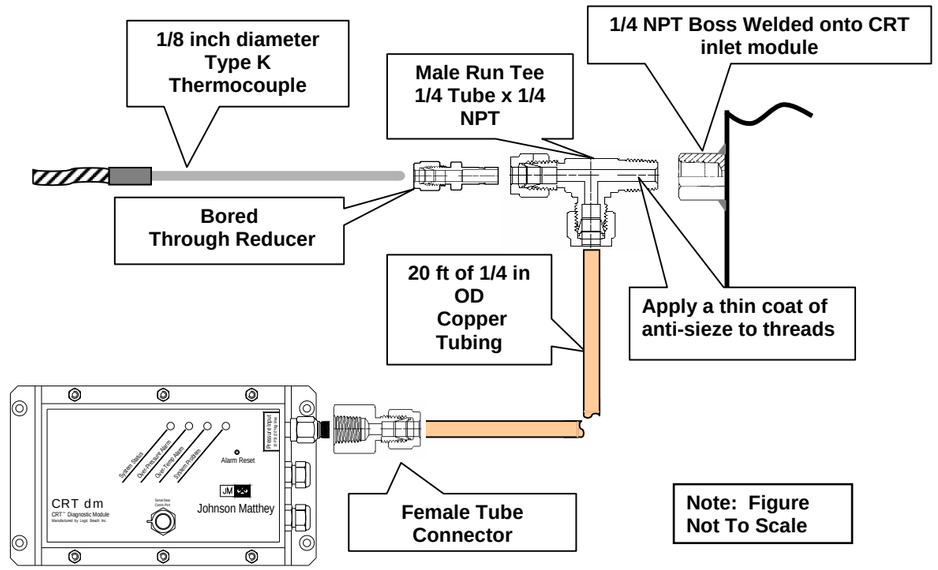


Figure 8: CRTdm Hardware Installation

Electrical Installation Diagram

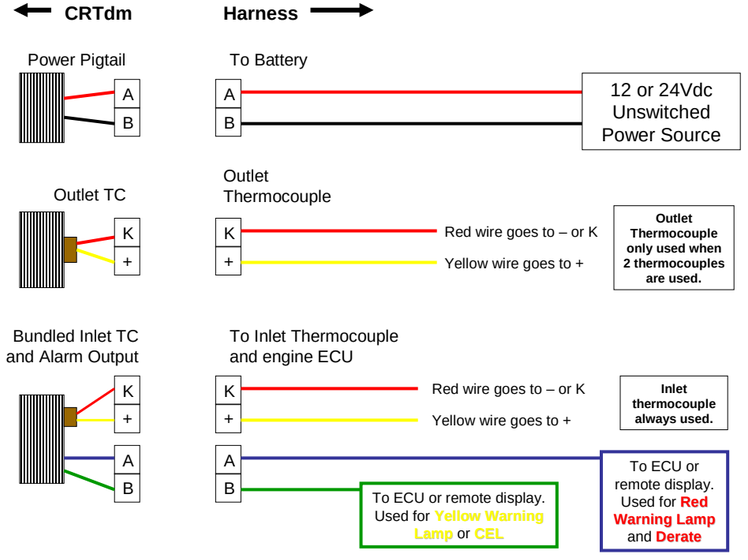


Figure 9: CRTdm Electrical Connections

Remote Display Module (If Applicable)

A Remote Display Module is available that will warn a driver if the CRTdm detects an alarm event. The RDM consists of a Power Adapter and a two LED display with 15 feet of wire terminated with Weather-Pack connectors that plug directly into the CRTdm (Figure 1). It is highly recommended to use a remote display if you are not interfacing with the engine ECM. **Failure to do so may void the CRT warranty**.

Figure 7: Johnson Matthey Remote Display Module (P/N 9363)

☑ **NOTE:** Once all of the mechanical and electrical connections are complete, reconnect the power to the vehicle. The green status light on the front of the CRTdm should begin flashing indicating that everything is operating correctly. If any alarm lights come on right after the unit is powered up, press the alarm reset button to clear the alarm. If the alarm persists please contact your local distributor.

☑ **NOTE:** The CRTdm power connector **MUST BE DISCONNECTED** if an electric welder is used on the vehicle. Failure to do may cause severe damage to the CRTdm and will void the CRTdm warranty.

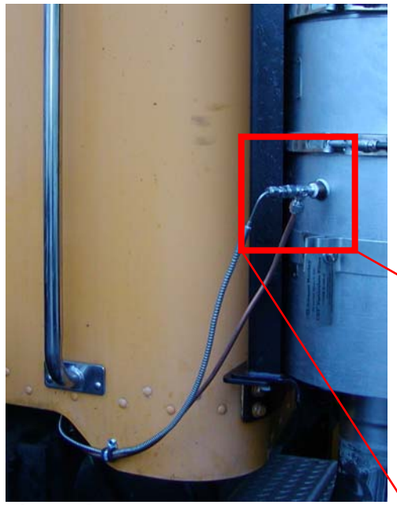


Figure 2: Connections at CRT / CCRT Inlet

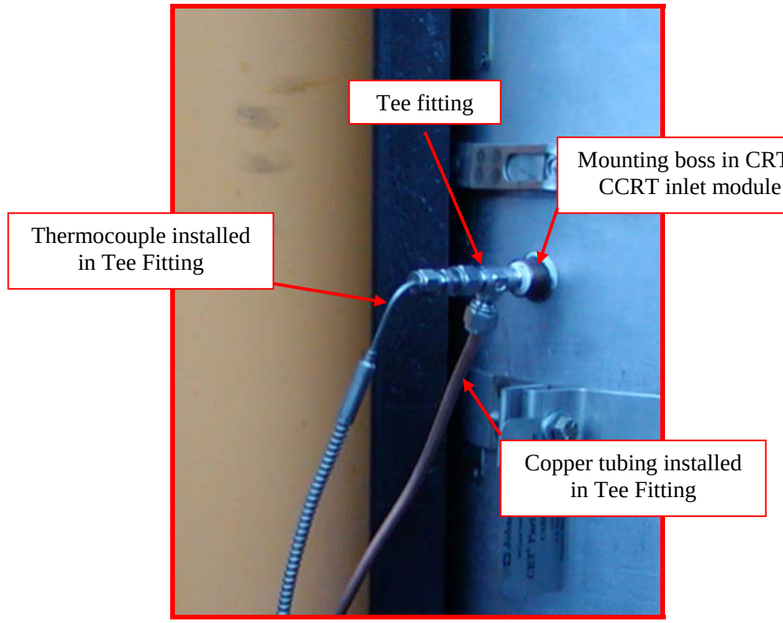


Figure 3: Close up of installed fittings

Installation of Fittings, Tubing and Thermocouple

☑ **NOTE:** The following instructions are to be used if you are using a Johnson Matthey supplied Installation Kit. Please refer to **CRTdm Hardware Installation** (Figure 8, page 17) and **Installation Parts List** (Table 2, page 5).

1. Apply a thin coat of anti-seize to the threads of the Male Run Tee and thread it into the boss on the CRT / CCRT inlet.

2. Insert the reducer fitting into the Tee fitting in line with the boss. Tighten the lock nut on the Tee until it is finger tight and then tighten it 1 ¼ turns with a 9/16" wrench (Figure 4).

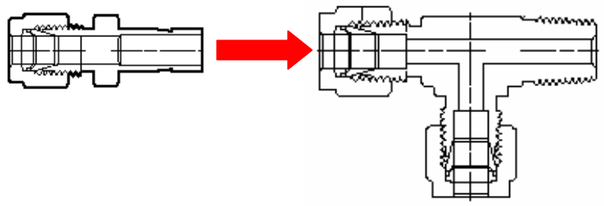


Figure 4: Reducer fitting and Tee-Fitting

3. Insert the thermocouple into the reducer as far as it will go, then pull it back 1 inch. Tighten the lock nut finger tight and then tighten 1 ¼ turns with a 7/16" wrench (Figure 5). If necessary, the thermocouple may be bent **ONCE** to avoid any interference. Do not bend the thermocouple past 90 degrees.

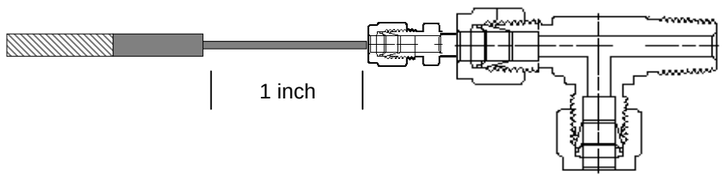


Figure 5: Inserting the thermocouple into the Tee-Fitting

Alarm Output Connections

There are two alarm output signals available from the CRTdm that can be connected to the auxiliary inputs of the engine control module (ECM) or to a remote dash mounted warning light.

The green and blue wires supplied with the installation kit are to be used to connect the CRTdm to either the ECM or the remote warning device.

The blue wire in port A of the female Weather-Pack connector of the Alarm Output pigtail (Page 6 Spot 11) is connected to alarm output 1, which is typically for a high-level alarm signal (High level back pressure alarm). It may also be connected to the engine ECM to activate an engine shutdown / derate or illuminate a Red warning light on a remote display.

The green wire in port B of the female Weather-Pack connector of the Alarm Output pigtail (Page 6 Spot 11) is connected to alarm output 2, which is typically for a low-level alarm signal (low level back pressure, high exhaust temperature, or sensor error within the CRTdm). This is typically connected to the ECM as a Check Engine Light or a Yellow warning light on a remote display.

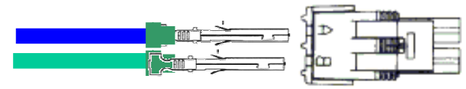
1. Using a Weather-Pack crimping tool, crimp the female terminals on the blue and green wires (if being used).	
2. Insert the blue wire into spot A of the Male Weather-Pack Connector. Insert green wire into spot B of the male Weather-Pack Connector.	

Table 5: Alarm Output connection

ECM interface of the alarm outputs is specific to each application. Contact your local distributor for specific instructions.

☑ **NOTE: Each Engine Manufacturer has specific ways of wiring the CRTdm into the ECM. Verify the alarm outputs are configured per engine manufacturer's instruction. Failure to do so may cause false alarms.**

Thermocouple Connection

The thermocouple is supplied with 20' of wiring attached. A portion of the wire is in a stainless steel shield to protect the wire from heat. The rest of the wire is in a brown shield. There is a red wire and a yellow wire inside of the brown shield.

1. Run the thermocouple wire from the CRT / CCRT inlet to the CRTdm. Cut off any excess wire (Table 4).

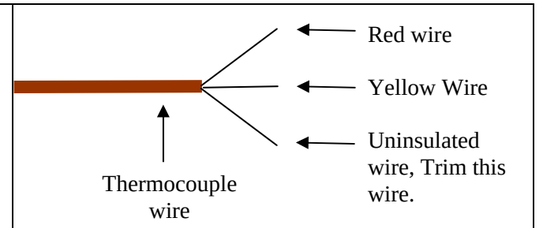
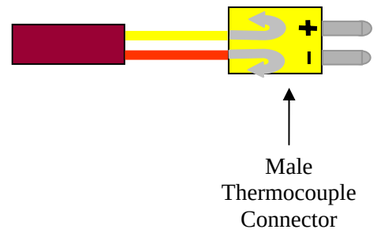
1. Strip ½ inch of brown jacketing and foil from the thermocouple wire exposing the red, yellow, and uninsulated leads. Trim the uninsulated wire back to the edge of the brown jacket.	
2. Strip ¼ of insulation from the red and yellow wires. Open the thermocouple connector and remove the red seal. Slide the seal over the wires to the edge of the brown jacket. Insert the **YELLOW wire into the + side** of the connector. Insert the **RED wire into the – side** of the connector. Reassemble the connector.	

Table 4: Installing the thermocouple connector

2. Peel away the brown shield to reveal the red, yellow, and bare wires.

3. Snip the bare wire back at the edge of the brown insulation.

4. Attach the **YELLOW** wire to the **positive (+)** pole on the thermocouple connector.

5. Attach the **RED** wire to the **Negative (- or K)** pole on the thermocouple connector.

☑ **NOTE:** Make sure the two wires are not touching inside the thermocouple connector. Failure to do so will cause the thermocouple to short out and will cause the CRTdm to Alarm.

6. Plug the thermocouple connector into the connector on the CRTdm. It can only be connected in one way.

7. The male and female thermocouple connectors can be wired together after they are plugged into each other using mechanics or safety wire. Wire the two halves together using mechanics or safety wire and trim excess wire.

4. Insert one end of the copper tubing into the fitting on the Tee that is at a 90° angle to the boss. Tighten the fitting on the Tee until it is finger tight. Then tighten it 1-1/4 turns with a 9/16" wrench (Figure 6).

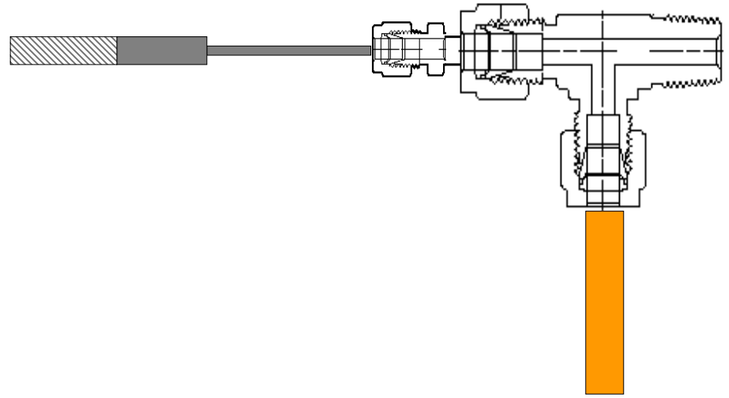


Figure 6: Tee-fitting with thermocouple and copper tubing installed

5. Loop the tubing at least once when running it from the CRT / CCRT system to the CRTdm. **All 20' of the tubing must be used** (+/- 18 inches)**.** If the distance between the CRT / CCRT system and the CRTdm is less than 20' the excess tubing should be looped and mounted in the vehicle.

6. Thread the female connector to the pressure sensor on the CRTdm with a 3/4" wrench. Insert the copper tube into the fitting. Tighten the lock nut on the fitting until it is finger tight. Then tighten it 1-1/4 turns with a 9/16" wrench.

☑ **NOTE:** All 20' (+/- 18 inches) of the tubing must be used or the CRTdm warranty will be void.

Electrical Installation

The standard CRTdm is a sealed unit with three external pigtails (refer to Figure 1 Page 6 and Figure 9 Page 17). The male Weather-Pack connector is for 12 or 24Vdc power supply to the CRTdm. The female Weather-Pack connector bundled with the female thermocouple connector marked **INLET** is used for the alarm outputs and the inlet temperature. This thermocouple connector is **ALWAYS** used.

The Female Thermocouple connector alone marked **OUTLET** is a secondary temperature input and is **only used when using two thermocouples**.

☑ **NOTE:** When using only one thermocouple, it must be plugged into the connector labeled **INLET** or else the CRTdm will alarm.

The standard installation kit contains the minimum required wiring for completing the necessary CRTdm electrical connections. The following instructions are for the standard CRTdm installation kit.

Specialized connectors and wiring harnesses may be available from your local distributor/dealer.

☑ **NOTE:** All wiring should be run in such a way that it is not in contact with heat sources such as the engine, exhaust manifolds or radiators. Protective wire loom supplied with the CRTdm installation kit should be used to cover the wiring. The wire loom can be secured in the vehicle with tie wrap or other fastening devices.

Power Connection

1. Locate a 12 or 24 volt power supply that is always available even when the key is turned off.

2. Run the red wire from the positive side of the power supply to the CRTdm. *Johnson Matthey recommends that a 3 Amp automotive type fuse be installed between the power supply and the CRTdm.*

3. Run the white wire from either the negative side of the power supply, or any other ground connection, to the CRTdm.

4. Insert the power wires in wire loom to protect them.

5. Refer to **Table 3** for the Weather-Pack crimping procedure.

6. After the terminals are crimped on the wires insert:

   a. The **RED** wire into port A of the female Weather-Pack connector
   b. The **WHITE** wire into port B of the female Weather-Pack connector

7. Plug the harness you created into the power pigtail of the CRTdm (Figure 1, Page 6, Spot 8).

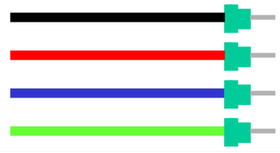
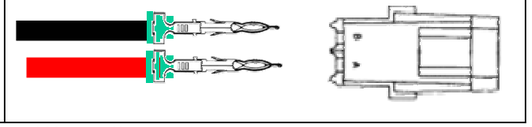
1. Slide Green silicon seals over power, ground, and alarm outputs (if being used). Strip ¼ inch of insulation from the wire. Slide the silicon seal to the edge of the stripped insulation.	
2. Using a Weather-Pack crimping tool, crimp the male terminals on the power and ground wires.	
3. Insert the Red wire into spot A of the Female Weather-Pack connector. Insert the White wire into spot B of the Female Weather-Pack Connector.	

Table 3: Proper Wiring Connections