

MODEL 415 AND 415R TEMPERATURE TRANSDUCERS

**DANIEL INSTRUMENTS, INC.
HOUSTON, TEXAS**

**Part Number: 3-9000-049
Revision G**

JULY 1997

DANIEL

Instruments, Inc.

**DANIEL INDUSTRIES, INC.
MODEL 415 AND 415R TEMPERATURE TRANSDUCERS
INSTRUCTION MANUAL**

NOTICE

DANIEL INDUSTRIES, INC. AND DANIEL INSTRUMENTS, INC. ("DANIEL") SHALL NOT BE LIABLE FOR TECHNICAL OR EDITORIAL ERRORS IN THIS MANUAL OR OMISSIONS FROM THIS MANUAL. **DANIEL MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THIS MANUAL AND, IN NO EVENT, SHALL DANIEL BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PRODUCTION, LOSS OF PROFITS, ETC.**

PRODUCT NAMES USED HEREIN ARE FOR MANUFACTURER OR SUPPLIER IDENTIFICATION ONLY AND MAY BE TRADEMARKS/REGISTERED TRADEMARKS OF THESE COMPANIES.

COPYRIGHT © 1997
BY DANIEL INSTRUMENTS, INC.
HOUSTON, TEXAS, U.S.A.

All rights reserved. No part of this work may be reproduced or copied in any form or by any means - graphic, electronic or mechanical - without first receiving the written permission of Daniel Instruments, Inc., Houston, Texas, U.S.A.

WARRANTY

Daniel Instruments, Inc. ("Daniel") warrants all equipment manufactured by it to be free from defects in workmanship and material, provided that such equipment was properly selected for the service intended, properly installed, and not misused. Equipment which is returned, transportation prepaid to Daniel within twelve (12) months of the date of shipment (eighteen (18) months from date of shipment for destinations outside of the United States), which is found after inspection by Daniel to be defective in workmanship or material, will be repaired or replaced at Daniel's sole option, free of charge, and return-shipped at lowest cost transportation. All transportation charges and export fees will be billed to the customer. Warranties on devices purchased from third party manufacturers not bearing a Daniel label shall have the warranty provided by the third party manufacturer.

Extended warranty - Models 2470, 2480 and 2500 are warranted for a maximum of twenty-four (24) months. The Danalyzer valves are warranted for the life of the instrument and the columns for five years.

The warranties specified herein are in lieu of any and all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

Daniel shall be liable only for loss or damage directly caused by its sole negligence. Daniel's liability for any loss or damage arising out of, connected with, or resulting from any breach hereof shall in no case exceed the price allocable to the equipment or unit thereof which gives rise to the claim. Daniel's liability shall terminate one year after the delivery of the equipment except for overseas deliveries and extended warranty products as noted above.

In no event, whether as a result of breach of warranty or alleged negligence, shall Daniel be liable for special or consequential damages, including, but not limited to, loss of profits or revenue; loss of equipment or any associated equipment; cost of capital; cost of substitute equipment, facilities or services; downtime costs; or claims of customers of the purchaser for such damages.

TABLE OF CONTENTS

Section	Page
SECTION 1 INTRODUCTION	
1.1 GENERAL	1-1
1.1.1 Model 415	1-1
1.1.2 Model 415R	1-1
1.2 MODEL 415 AND MODEL 415R SPECIFICATIONS	1-3
1.2.1 Functional	1-3
1.2.2 Performance	1-4
1.2.3 Physical	1-4
SECTION 2 INSTALLATION	
2.1 GENERAL	2-1
2.2 UNPACKING	2-1
2.3 DAMAGE TO THE INSTRUMENT IN SHIPPING	2-1
2.4 SHIPPING INSTRUCTIONS	2-1
2.5 MODEL 415 INSTALLATION	2-2
2.5.1 Mechanical Installation	2-2
2.5.2 Field Wiring	2-2
2.6 MODEL 415R INSTALLATION	2-2
2.6.1 Mechanical Installation	2-2
2.6.2 Field Wiring	2-3
2.7 MODEL 415 AND MODEL 415R POWER SUPPLY REQUIREMENTS.	2-4
2.8 TRANSIENT PROTECTION	2-5
2.9 WHEN TO CALIBRATE THE MODEL 415 AND MODEL 415R	2-5

SECTION 3 OPERATION

3.1 **GENERAL** 3-1

3.2 **FIELD CALIBRATION OF THE MODEL 415 AND MODEL 415R** 3-1

3.2.1 Required Test Equipment 3-1

3.2.2 Calibration Procedure 3-2

3.3 **STANDARD TEMPERATURE RANGES** 3-3

SECTION 4 MAINTENANCE

4.1 **GENERAL** 4-1

4.2 **MAINTENANCE** 4-1

4.3 **RECOMMENDED SPARE PARTS** 4-1

4.4 **CUSTOMER PROBLEM REPORT** 4-1

4.5 **SHIPPING INSTRUCTIONS** 4-1

APPENDIX A

DRAWINGS AND SPARE PARTS LISTS A-1

LIST OF ILLUSTRATIONS

Figure 2-1. Error due to Cable Length 2-3

SECTION 1

INTRODUCTION

1.1 GENERAL

The Model 415 and Model 415R Temperature Transducers are 2-wire, 4 to 20 mA transducers designed to measure process fluid temperatures in pipe sizes from 2 to 24 inches.

1.1.1 Model 415

The Model 415 is a self-contained unit consisting of a base of stainless steel, a cover of either aluminum or stainless steel, a platinum element stainless steel sensor probe of either the threaded or the easily removable spring loaded type, and an electronics module.

The unit is thread-mounted with or without a thermowell. A thermowell is optionally supplied. Thermowells are made from 304 s.s., 316 s.s., and K-Monel, and can be ordered with or without lagging. Others are available on special order.

The temperature range of the transducer is determined by two resistors mounted on the terminal strip of the electronics module. Standard temperature ranges cover 0 to 400 °F. Special ranges are produced for temperatures between -148 and 500 °F by connecting appropriately sized resistors to the terminal strip on the electronics module.

1.1.2 Model 415R

The Model 415R is contained in two units - the temperature sensing unit, and the remote electronics unit.

The temperature sensing unit consists of a base of stainless steel, a cover of either aluminum or stainless steel, and a platinum element stainless steel sensor probe of either the threaded or the easily removable spring-loaded type.

The temperature sensing unit is thread-mounted with or without a thermowell. A thermowell is optionally supplied. Thermowells are made from 304 s.s., 316 s.s., and K-Monel, with or without lagging. Others are available on special order.

The remote electronics unit consists of a base of stainless steel, a cover of either aluminum or stainless steel, a cast aluminum mounting bracket designed to be either post or panel mounted, and an electronics module.

The temperature range of the Model 415R is determined by three resistors mounted on the terminal strip on the electronics module. Standard temperature ranges cover 0 to 400 °F. Special ranges are produced for temperatures between -148 and 500 °F by connecting appropriately sized resistors to the terminal strip on the electronics module.

1.2 MODEL 415 AND MODEL 415R SPECIFICATIONS

1.2.1 Functional

- A. Temperature ranges:
 - 0 to 100 °F 0 to 200 °F
 - 0 to 150 °F 0 to 250 °F
 - 0 to 180 °F 0 to 300 °F
 - 40 to 200 °F 0 to 400 °F
 - 32 to 212 °F

- B. Output signal:
 - 4-20 mA.

- C. Voltage drop across transmitter:
 - 12 Vdc minimum, 45 Vdc maximum.
 - (Transmitter line terminals can be connected with either polarity).

- D. Type of sensor:
 - 500 ohm precision platinum resistance element.

- E. Ambient temperature limits:
 - Storage: -40 to 180 °F,
 - Operating: -20 to 160 °F.

- F. Humidity limits:
 - 0 to 100% RH (non-condensing).

- G. Sensitivity adjustment:
 - ±5% of span minimum.

- H. Zero adjustment:
 - ±5 °F minimum.

1.2.2 Performance

- A. Combined independent linearity, hysteresis, and repeatability:
 $\pm 0.05\%$ of span for spans of 100 °F or greater.
- B. Ambient temperature error band:
 $\pm 1.0\%$ full scale per 100 °F maximum, including zero and span errors over the operating ambient temperature range.
- C. Power supply error:
Less than $\pm 0.0005\%$ full scale per volt.
- D. Load effect:
Minimal, other than power supply error.
- E. Time constant:
(0 to 63% change) thermowell filled with mineral oil, 30 seconds.
Thermowell with air, 40 seconds.

1.2.3 Physical

- A. Materials of construction
 - Process body:
316 s.s.
 - Cover:
aluminum or 316 s.s.
 - Sensing probe:
platinum resistance element in 316 s.s. sheath.
- B. Probe connection:
1/2" N.P.T. male.
- C. Electrical conduit connection:
1/2" N.P.T. female.
- D. Weight:
4 pounds.

- E. Mounting:
415 one unit (probe/electronics)
415R two units (probe and remote electronics).
- F. Dimensions:
Approximately 3 inches by 5-3/4 inches by 3-5/8 inches (base with cover attached).
- G. Thermowell
- Material:
304 s.s. (standard), 316 s.s., or K-Monel.
- Process connection:
1/2" N.P.T., 3/4" N.P.T. (standard), or 1" N.P.T.

Length: See table below:

Line size (I.D.)	Thermowell length (below threads)	Probe length (below threads)	Lagging (optional)
2"	2-1/2"	3-1/4"	2"
3"	2-1/2"	3-1/4"	2"
4"	4-1/2"	5-1/4"	3"
6"	4-1/2"	5-1/4"	3"
8"	7-1/2"	8-1/4"	3"
10"	7-1/2"	8-1/4"	3"
12"	7-1/2"	8-1/4"	3"
14"	10-1/2"	11-1/4"	3"
16"	10-1/2"	11-1/4"	3"
18"	10-1/2"	11-1/4"	3"
20"	13-1/2"	14-1/4"	3"
24"	13-1/2"	14-1/4"	3"

H. Sensor mounting:

Threaded probe

Removable spring-loaded probe

I. Model 415R remote electronics unit:

No flying splices required on compensating loop and remote sensor. Wire sizes from #22 to #18 AWG can be used for remote sensor and compensating loop.

SECTION 2

INSTALLATION

2.1 GENERAL

This section contains unpacking, damage in shipment claims handling, and connecting instructions for the Model 415 and Model 415R.

2.2 UNPACKING

Carefully unpack the equipment. Retain all packing materials until an inspection of the instrument can be made.

2.3 DAMAGE TO THE INSTRUMENT IN SHIPPING

Claims should first be filed with the carrier if the instrument has been damaged in shipment. Forward a full report of the damage to the factory and include the serial number engraved on the probe tubing. Disposition instructions will be forwarded immediately.

2.4 SHIPPING INSTRUCTIONS

After receiving instructions from the factory, pack the instrument in its original packing materials (if still available) or in a carton or box with two or three inches of shock absorbing material surrounding it. Ship prepaid via the most suitable method.

2.5 MODEL 415 INSTALLATION

2.5.1 Mechanical Installation

Install a properly sized thermowell into the process fitting. Mount the Model 415 by screwing the unit into the thermowell after filling the thermowell with mineral oil.

NOTE: Daniel thermowells are designed to provide approximately 1/4-inch probe tip clearance when used with the specified sensor length. When using a thermowell other than the one supplied with the transducer, check to be sure that the thermowell and transducer are compatible, and that sufficient probe tip clearance exists.

If a thermowell is not being used, screw the unit directly into the process fitting.

2.5.2 Field Wiring

Wire the Model 415 as shown on drawing BE-8530 in section 5. Notice that the two output terminals are labeled "line non-polar". The unit will operate equally well, regardless of the polarity of the line connection.

2.6 MODEL 415R INSTALLATION

2.6.1 Mechanical Installation

Install a properly sized thermowell into the process fitting. Mount the temperature sensing unit of the Model 415R into the thermowell after filling the thermowell with mineral oil.

NOTE: Daniel thermowells are designed to provide approximately 1/4-inch probe tip clearance when used with the specified sensor length. When using a thermowell other than the one supplied with the transducer, check to be sure that the thermowell and transducer are compatible, and that sufficient probe tip clearance exists.

If a thermowell is not being used, screw the temperature sensing unit directly into the process fitting.

Mount the remote electronics unit as required by its mounting bracket.

2.6.2 Field Wiring

Wire the Model 415R as shown in the field wiring diagram BE-8540, located in section 5. Notice that the two output terminals are labeled "line non-polar". The units will operate equally well regardless of the polarity of the line connection.

Interconnect the temperature sensing unit and the remote electronics unit of the Model 415R with a four-conductor cable. All four conductors must be of the same wire size (either 10, 20, or 22 AWG). Figure 2-1 shows the maximum expected error which is added by the four-conductor cable of the Model 415R.

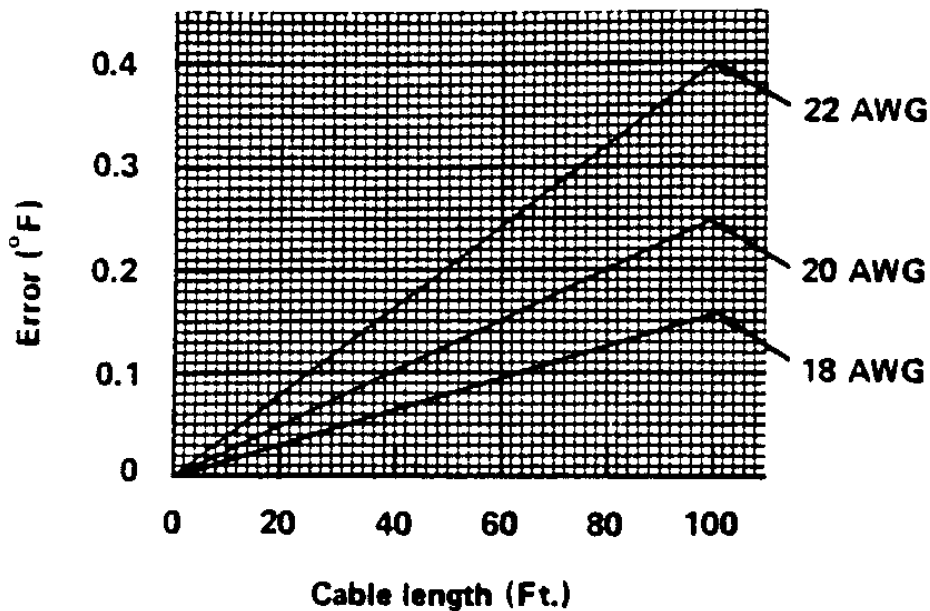


Figure 2-1. Error due to Cable Length

Low resistance terminations on the four-conductor cable are essential to proper operation. Use the correct size crimping tool for lugging these wires. If this tool is not available, make soldered connections to the terminal lugs. Use the terminal lugs supplied with the transducers.

2.7 MODEL 415 AND MODEL 415R POWER SUPPLY REQUIREMENTS

Voltage across the transmitter terminals must be at least 12 volts and no more than 45 volts. Therefore, to determine the voltage requirement of the power supply; first, determine the line resistance between the power supply and the transmitter, and second, determine the load resistance. The required power supply limits can then be calculated with the following equations:

$$V_{ps_{min}} = I_{max} \cdot R_{line} + I_{max} \cdot R_{load} + 12 \quad (1)$$

$$V_{ps_{max}} = I_{min} \cdot R_{line} + I_{min} \cdot R_{load} + 45 \quad (2)$$

For example, assume a line resistance of 10 ohms and a load resistance of 500 ohms ($I_{max} = 20$ mA and $I_{min} = 4$ mA). To solve equation (1) with the example above we have:

$$V_{ps_{min}} = 0.02 \cdot 10 + 0.02 \cdot 500 + 12 = 22.2 \text{ V}$$

To solve equation (2) with the example above we have:

$$V_{ps_{max}} = 0.004 \cdot 10 + 0.004 \cdot 500 + 45 = 47.04 \text{ V}$$

Therefore, voltage needed for the above example would dictate a power supply with an output voltage between 22.2 and 47.04 volts.

A regulated power supply is normally not required. The primary requirement is that the power supply voltage always satisfy the minimum and maximum requirements, under all conditions, as determined in equations (1) and (2) above.

One hundred and twenty hertz ripple from an unregulated supply is effectively removed from the signal by the transducer. It is recommended, however, that the ripple not exceed approximately 0.5 volts peak-to-peak.

Daniel Flow Computers contain transducer power supplies that satisfy most applications. Exceptionally long transducer lines and multiple loads may disqualify their use. Refer to the transducer power specifications in the flow computer's manual to determine if this supply meets the voltage requirements as determined in equations (1) and (2) above.

2.8 TRANSIENT PROTECTION

High energy electrical transients induced on the line by lightning are a frequent cause of electrical failure of a transducer. Therefore, it is recommended that properly sized transient protectors be incorporated in the installation (ref. Daniel publication DI 2070, Model 237 Transient Protector product bulletin).

2.9 WHEN TO CALIBRATE THE MODEL 415 AND MODEL 415R

Calibration of the Model 415 and Model 415R is required under the following conditions:

- When the range of the transducer is changed by changing the range resistors.
- When the electronics module is replaced.
- When the platinum element probe is replaced.
- And for the 415R only - when the four-conductor interconnecting cable causes a greater error than can be tolerated (ref. Figure 2-1).

This page intentionally left blank.

SECTION 3

OPERATION

3.1 GENERAL

This section contains field calibration instructions for the Model 415 and Model 415R.

3.2 FIELD CALIBRATION OF THE MODEL 415 AND MODEL 415 R

Since the transducer was calibrated at the factory, field calibration is not recommended. The field calibration procedure is included for desired periodic checks of the equipment's accuracy, or rarer, for when equipment fails and replacements must be calibrated (ref. section 2.9).

3.2.1 Required Test Equipment

If calibration is required in the field, certain test equipment should be available.

NOTE: Under no circumstances should adjustments be made to the transducer without the proper test equipment.

- A. Precision load resistor:
This resistor should be a precision, wirewound resistor, 100 ohms, ± 0.02 percent, 1/4 watt. It will be used to provide 0.4 to 2 volts proportional to 4 to 20 mA current.
- B. Digital voltmeter (D.V.M.)
A Fluke Model 8600A or equivalent, with a calibrated accuracy of ± 0.01 percent.
- C. Precision resistance decade box:
Vishay Instruments Model V/E 40, or equivalent.
- D. Power supply:
Output: 20 to 45 Vdc.
Minimum current capability: 20 mA.
- E. Insulation varnish:
GC Electronics Red GLPT Insulation Varnish or equivalent.

3.2.2 Calibration Procedure

From Table 3-1 determine both the sensor probe's resistance corresponding to the 4 mA and 20 mA temperatures. Note that these resistances are table values and are applicable only to sensor probes with a resistance of 500.00 ohms at 32 °F.

Although it is unlikely that each sensor probe will have a resistance value of exactly 500 ohms at 32 °F, by using Table 3-1 and a simple calculation, the correctly extrapolated sensor probe resistances can be found as follows:

First, look at the serial number on the probe tubing for the actual resistance of the sensor probe at 32 °F. This value will be used in the following equations where applicable for the term "act. R @ 32 °F".

Second, perform the following two calculations:

Sensor probe's actual resistance at the 4 mA temperature is

$$act.R_{4\text{ mA}} = \text{Table 3-1 } R_{4\text{ mA}} \frac{act. R @ 32^{\circ}F}{500} \quad (3)$$

Sensor probe's actual resistance at the 20 mA temperature is:

$$act.R_{20\text{ mA}} = \text{Table 3-1 } R_{20\text{ mA}} \frac{act. R @ 32^{\circ}F}{500} \quad (4)$$

- A. Connect the 100 ohm resistor in series with one output wire. Connect the DVM to measure the voltage drop across this resistor.
- B. Model 415 - Disconnect the sensor probe from its terminal strip, and connect in its place the decade resistance box. Use two wires, #22 AWG, approximately one foot long.

Model 415R - At the terminal strip on the temperature sensing unit, disconnect the sensor probe and connect in its place the decade resistance box. Use two wires, #22 AWG, approximately one foot long.

- C. Steps C through G apply to both the Model 415 and Model 415R.

Set the results of equation (3) above into the decade box and adjust the ZERO potentiometer for a DVM reading of 0.4000 volt.

- D. Set the results of equation (4) above into the decade box and adjust the SPAN potentiometer for a DVM reading of 2 volts (1.9999 if using a Fluke Model 8600A DVM).
- E. Repeat steps C and D until the ZERO and SPAN settings are correct for both the 4 mA and 20 mA conditions (i.e., within 0.0002 volt).
- F. Secure the potentiometer adjustments by placing a dab of red GLPT so that it touches both the potentiometer's screw and housing.
- G. Remove the 100 ohm resistor and the decade box. Reconnect the transducer for normal operation.

3.3 STANDARD TEMPERATURE RANGES

Standard temperature ranges cover 0 to 400 °F. Special ranges are produced for temperatures between -148 and 500 °F by connecting appropriately sized resistors to the terminal strip on the electronics module of the Model 415 and the remote electronic unit of the Model 415R. Resistance values applicable to the various standard temperature ranges for the Model 415 are listed on Drawing BE-8498 (ref. section 5) and for the Model 415R on Drawing BE-8508 (ref. section 5).

Table 3-1. Five-Hundred OHM Probe Resistances (OHMS) at Various Temperatures (°F)

°F	OHMS	°F	OHMS	° F	OHMS
-300.0	125.55	-256.0	177.45	-212.0	228.45
-299.0	126.75	-255.0	178.65	-211.0	229.60
-298.0	127.95	-254.0	179.80	-210.0	230.75
-297.0	129.15	-253.0	180.95	-209.0	231.90
-296.0	130.35	-252.0	182.15	-208.0	233.05
-295.0	131.50	-251.0	183.30	-207.0	234.20
-294.0	132.70	-250.0	164.45	-206.0	235.35
-293.0	133.90	-249.0	185.65	-205.0	236.50
-292.0	135.10	-248.0	186.80	-204.0	237.60
-291.0	136.25	-247.0	187.95	-203.0	238.75
-290.0	137.45	-246.0	189.10	-202.0	239.90
-289.0	138.65	-245.0	190.30	-201.0	241.05
-288.0	139.80	-244.0	191.45	-200.0	242.20
-287.0	141.00	-243.0	192.60	-199.0	243.35
-286.0	142.20	-242.0	193.80	-198.0	244.50
-285.0	143.35	-241.0	194.95	-197.0	245.65
-284.0	144.55	-240.0	196.10	-196.0	246.80
-283.0	145.75	-239.0	197.25	-195.0	247.90
-282.0	146.90	-238.0	198.40	-194.0	249.05
-281.0	148.10	-237.0	199.60	-193.0	250.20
-280.0	149.30	-236.0	200.75	-192.0	251.35
-279.0	150.45	-235.0	201.90	-191.0	252.50
-278.0	151.65	-234.0	203.05	-190.0	253.65
-277.0	152.80	-233.0	204.20	-189.0	254.75
-276.0	154.00	-232.0	205.35	-188.0	255.90
-275.0	155.20	-231.0	206.55	-187.0	257.05
-274.0	156.35	-230.0	207.70	-186.0	258.20
-273.0	157.55	-229.0	208.85	-185.0	259.35
-272.0	158.70	-228.0	210.00	-184.0	260.45
-271.0	159.90	-227.0	211.15	-183.0	261.60
-270.0	161.05	-226.0	212.30	-182.0	262.75
-269.0	162.25	-225.0	213.45	-181.0	263.90
-268.0	163.40	-224.0	214.60	-180.0	265.00
-267.0	164.60	-223.0	215.75	-179.0	266.15
-266.0	165.75	-222.0	216.95	-178.0	267.30
-265.0	166.95	-221.0	218.10	-177.0	268.45
-264.0	168.10	-220.0	219.25	-176.0	269.55
-263.0	169.25	-219.0	220.40	-175.0	270.70
-262.0	170.45	-218.0	221.55	-174.0	271.85
-261.0	171.60	-217.0	222.70	-173.0	273.00
-260.0	172.80	-216.0	223.85	-172.0	274.10
-259.0	173.95	-215.0	225.00	-171.0	275.25
-258.0	175.15	-214.0	226.15	-170.0	276.40
-257.0	176.30	-213.0	227.30	-169.0	277.50

MODEL 415 AND 415R TEMPERATURE TRANSDUCERS

JUL 1997

°F	OHMS	°F	OHMS	° F	OHMS
-168.0	278.65	-122.0	330.45	-76.0	381.65
-167.0	279.80	-121.0	331.55	-75.0	382.75
-166.0	280.90	-120.0	332.70	-74.0	383.85
-165.0	282.05	-119.0	333.80	-73.0	384.95
-164.0	283.20	-118.0	334.90	-72.0	386.05
-163.0	284.30	-117.0	336.05	-71.0	387.20
-162.0	285.45	-118.0	337.15	-70.0	388.30
-161.0	286.55	-115.0	338.25	-69.0	389.40
-160.0	287.70	-114.0	339.40	-68.0	390.50
-159.0	288.85	-113.0	340.50	-67.0	391.60
-158.0	289.95	-112.0	341.60	-66.0	392.70
-157.0	291.10	-111.0	342.75	-65.0	393.80
-156.0	292.20	-110.0	343.85	-64.0	394.90
-155.0	293.35	-109.0	344.95	-63.0	396.00
-154.0	294.50	-108.0	346.10	-62.0	397.10
-153.0	295.60	-107.0	347.20	-61.0	398.25
-152.0	296.75	-106.0	348.30	-60.0	399.35
-151.0	297.85	-105.0	349.45	-59.0	400.45
-150.0	299.00	-104.0	350.55	-58.0	401.55
-149.0	300.10	-103.0	351.65	-57.0	402.65
-148.0	301.25	-102.0	352.75	-56.0	403.75
-147.0	302.35	-101.0	353.90	-55.0	404.85
-146.0	303.50	-100.0	355.00	-54.0	405.95
-145.0	304.60	-99.0	356.10	-53.0	407.05
-144.0	305.75	-98.0	357.20	-52.0	408.15
-143.0	306.90	-97.0	358.35	-51.0	409.25
-142.0	308.00	-96.0	359.45	-50.0	410.35
-141.0	309.15	-95.0	360.55	-49.0	411.45
-140.0	310.25	-94.0	361.65	-48.0	412.55
-139.0	311.35	-93.0	362.80	-47.0	413.65
-138.0	312.50	-92.0	363.90	-46.0	414.75
-137.0	313.60	-91.0	365.00	-45.0	415.85
-136.0	314.75	-90.0	366.10	-44.0	416.95
-135.0	315.85	-89.0	367.25	-43.0	418.05
-134.0	317.00	-88.0	368.65	-42.0	419.15
-133.0	318.10	-87.0	369.45	-41.0	420.25
-132.0	319.25	-86.0	370.55	-40.0	421.35
-131.0	320.35	-85.0	371.65	-39.0	422.45
-130.0	321.50	-84.0	372.80	-38.0	423.55
-129.0	322.60	-83.0	373.90	-37.0	424.65
-128.0	323.70	-82.0	375.00	-36.0	425.75
-127.0	324.85	-81.0	376.10	-35.0	426.85
-126.0	325.95	-80.0	377.20	-34.0	427.95
-125.0	327.10	-79.0	378.30	-33.0	429.05
-124.0	328.20	-78.0	379.45	-32.0	430.15
-123.0	329.30	-77.0	380.55	-31.0	431.25

°F	OHMS	°F	OHMS	° F	OHMS
-30.0	432.35	16.0	482.60	62.0	532.50
-29.0	433.45	17.0	483.70	63.0	533.55
-28.0	434.55	18.0	484.80	64.0	534.65
-27.0	435.65	19.0	485.85	65.0	535.70
-26.0	436.75	20.0	486.95	66.0	536.80
-25.0	437.85	21.0	488.05	67.0	537.90
-24.0	438.90	22.0	489.15	68.0	538.95
-23.0	440.00	23.0	490.20	69.0	540.05
-22.0	441.10	24.0	491.30	70.0	541.10
-21.0	442.20	25.0	492.40	71.0	542.20
-20.0	443.30	26.0	493.50	72.0	543.30
-19.0	444.40	27.0	494.55	73.0	544.35
-18.0	445.50	28.0	495.65	74.0	545.45
-17.0	446.60	29.0	496.75	75.0	546.50
-16.0	447.70	30.0	497.85	76.0	547.60
-15.0	448.80	31.0	498.90	77.0	548.65
-14.0	449.85	32.0	500.00	78.0	549.75
-13.0	450.95	33.0	501.10	79.0	550.80
-12.0	452.05	34.0	502.15	80.0	551.90
-11.0	453.15	35.0	503.25	81.0	553.00
-10.0	454.25	36.0	504.35	82.0	554.05
-9.0	455.35	37.0	505.45	83.0	555.15
-8.0	456.45	38.0	506.50	84.0	556.20
-7.0	457.55	39.0	507.60	85.0	557.30
-6.0	458.60	40.0	508.70	86.0	558.35
-5.0	459.70	41.0	509.75	87.0	559.45
-4.0	460.80	42.0	510.85	88.0	560.50
-3.0	461.90	43.0	511.95	89.0	561.60
-2.0	463.00	44.0	513.00	90.0	562.65
-1.0	464.10	45.0	514.10	91.0	563.75
0.0	465.15	46.0	515.20	92.0	564.50
1.0	466.25	47.0	516.25	93.0	565.90
2.0	467.35	48.0	517.35	94.0	566.95
3.0	468.45	49.0	518.45	95.0	568.05
4.0	469.55	50.0	519.50	96.0	569.10
5.0	470.65	51.0	520.60	97.0	570.20
6.0	471.70	52.0	521.65	98.0	571.25
7.0	472.80	53.0	522.75	99.0	572.35
8.0	473.90	54.0	523.85	100.0	573.40
9.0	475.00	55.0	524.90	101.0	574.50
10.0	476.10	56.0	526.00	102.0	575.55
11.0	477.15	57.0	527.10	103.0	576.60
12.0	478.25	58.0	528.15	104.0	577.70
13.0	479.35	59.0	529.25	105.0	578.75
14.0	480.45	60.0	530.30	106.0	579.85
15.0	481.50	61.0	531.40	107.0	580.90

MODEL 415 AND 415R TEMPERATURE TRANSDUCERS

JUL 1997

°F	OHMS	°F	OHMS	° F	OHMS
108.0	582.00	154.0	631.10	200.0	679.85
109.0	583.05	155.0	632.15	201.0	680.90
110.0	584.15	156.0	633.25	202.0	681.95
111.0	585.20	157.0	634.30	203.0	683.00
112.0	586.25	158.0	635.35	204.0	684.05
113.0	587.35	159.0	636.40	205.0	685.10
114.0	588.40	160.0	637.50	206.0	686.20
115.5	589.50	161.0	638.55	207.0	687.25
116.0	590.55	162.0	639.60	208.0	688.30
117.0	591.60	163.0	640.65	209.0	689.35
118.0	592.70	164.0	641.75	210.0	690.40
119.0	593.75	165.0	642.80	211.0	691.45
120.0	594.85	166.0	643.85	212.0	692.50
121.0	595.90	167.0	644.90	213.0	693.55
122.0	596.95	168.0	646.00	214.0	694.60
123.0	596.05	169.0	647.05	215.0	695.65
124.0	599.10	170.0	648.10	216.0	696.70
125.0	600.20	171.0	649.15	217.0	697.75
126.0	601.25	172.0	650.20	218.0	698.80
127.0	602.30	173.0	651.30	219.0	699.85
128.0	603.40	174.0	652.35	220.0	700.90
129.0	604.45	175.0	653.40	221.0	701.95
130.0	605.50	176.0	654.45	222.0	703.00
131.0	606.60	177.0	655.50	223.0	704.10
132.0	607.65	178.0	656.60	224.0	705.15
133.0	608.75	179.0	657.65	225.0	706.20
134.0	609.80	180.0	658.70	226.0	707.25
135.0	610.85	181.0	659.75	227.0	708.30
136.0	511.95	182.0	660.80	228.0	709.35
137.0	613.00	183.0	661.90	229.0	710.40
138.0	614.05	184.0	662.95	230.0	711.45
139.0	615.15	185.0	664.00	231.0	712.50
140.0	616.20	186.0	665.05	232.0	713.55
141.0	617.25	187.0	666.10	233.0	714.60
142.0	618.35	188.0	667.15	234.0	715.65
143.0	619.40	189.0	668.25	235.0	716.70
144.0	620.45	190.0	669.30	236.0	717.75
145.0	621.50	191.0	670.35	237.0	718.80
146.0	622.60	192.0	671.40	238.0	719.85
147.0	623.65	193.0	672.45	239.0	720.90
148.0	624.70	194.0	673.50	240.0	721.90
149.0	625.80	195.0	674.55	241.0	722.95
150.0	626.85	196.0	675.60	242.0	724.00
151.0	627.90	197.0	676.70	243.0	725.05
152.0	629.00	198.0	677.75	244.0	726.10
153.0	630.05	199.0	678.80	245.0	727.15

°F	OHMS	°F	OHMS	° F	OHMS
246.0	728.20	292.0	776.20	338.0	823.80
247.0	729.25	293.0	777.25	339.0	824.85
248.0	730.30	294.0	778.30	340.0	825.85
249.0	731.35	295.0	779.30	341.0	826.90
250.0	732.40	296.0	780.35	342.0	827.95
251.0	733.45	297.0	781.40	343.0	828.95
252.0	734.50	298.0	782.45	344.0	830.00
253.0	735.55	299.0	783.45	345.0	831.00
254.0	736.60	300.0	784.50	346.0	832.05
255.0	737.65	301.0	785.55	347.0	833.10
256.0	738.70	302.0	786.60	348.0	834.10
257.0	739.70	303.0	787.60	349.0	835.15
258.0	740.75	304.0	788.65	350.0	836.15
259.0	741.80	305.0	789.70	351.0	837.20
260.0	742.85	306.0	790.75	352.0	838.20
261.0	743.90	307.0	791.75	353.0	839.25
262.0	744.95	308.0	792.80	354.0	840.30
263.0	746.00	309.0	793.85	355.0	841.30
264.0	747.05	310.0	794.85	356.0	842.35
265.0	748.10	311.0	795.90	357.0	843.35
266.0	749.10	312.0	796.95	358.0	844.40
267.0	750.15	313.0	798.00	359.0	845.40
268.0	751.20	314.0	799.00	360.0	846.45
269.0	752.25	315.0	800.05	361.0	847.45
270.0	753.30	316.0	801.10	362.0	848.50
271.0	754.35	317.0	802.10	363.0	849.50
272.0	755.40	318.0	803.15	364.0	850.55
273.0	756.40	319.0	804.20	365.0	851.60
274.0	757.45	320.0	805.20	366.0	852.60
275.0	758.50	321.0	806.25	367.0	853.65
276.0	759.55	322.0	807.30	368.0	854.65
277.0	760.60	323.0	808.35	369.0	855.70
278.0	761.65	324.0	809.35	370.0	856.70
279.0	762.70	325.0	810.40	371.0	857.75
280.0	763.70	326.0	811.40	372.0	858.75
281.0	764.75	327.0	812.45	373.0	859.80
282.0	765.80	328.0	813.50	374.0	860.80
283.0	766.85	329.0	814.50	375.0	861.85
284.0	767.90	330.0	815.55	376.0	862.85
285.0	768.90	331.0	816.60	377.0	863.90
286.0	769.95	332.0	817.60	378.0	864.90
287.0	771.00	333.0	818.65	379.0	865.90
288.0	772.05	334.0	819.70	380.0	866.95
289.0	773.10	335.0	820.70	381.0	867.95
290.0	774.10	336.0	821.75	382.0	869.00
291.0	775.15	337.0	822.80	383.0	870.00

MODEL 415 AND 415R TEMPERATURE TRANSDUCERS

JUL 1997

°F	OHMS	°F	OHMS	° F	OHMS
384.0	871.05	430.0	917.90	476.0	964.35
385.0	872.05	431.0	918.90	477.0	965.40
386.0	873.10	432.0	919.90	478.0	966.40
387.0	874.10	433.0	920.95	479.0	967.40
388.0	875.15	434.0	921.95	480.0	968.40
389.0	876.15	435.0	922.95	481.0	969.40
390.0	877.15	436.0	924.00	482.0	970.40
391.0	878.20	437.0	925.00	483.0	971.40
392.0	879.20	438.0	926.00	484.0	972.40
393.0	880.25	439.0	927.00	485.0	973.40
394.0	881.25	440.0	928.05	486.0	974.40
395.0	882.30	441.0	929.05	487.0	975.45
396.0	883.30	442.0	930.05	488.0	976.45
397.0	884.30	443.0	931.05	489.0	977.45
398.0	885.35	444.0	932.10	490.0	978.45
399.0	886.35	445.0	933.10	491.0	979.45
400.0	887.40	446.0	934.10	492.0	980.45
401.0	888.40	447.0	935.10	493.0	981.45
402.0	889.40	448.0	936.15	494.0	982.45
403.0	890.45	449.0	937.15	495.0	983.45
404.0	891.45	450.0	938.15	496.0	984.45
405.0	892.50	451.0	939.15	497.0	985.45
406.0	893.50	452.0	940.15	498.0	986.45
407.0	894.50	453.0	941.20	499.0	987.45
408.0	895.55	454.0	942.20	500.0	988.45
409.0	896.55	455.0	943.20		
410.0	897.55	456.0	944.20		
411.0	898.60	457.0	945.20		
412.0	899.60	458.0	946.25		
413.0	900.60	459.0	947.25		
414.0	901.65	460.0	948.25		
415.0	902.65	461.0	949.25		
416.0	903.65	462.0	950.25		
417.0	904.70	463.0	951.25		
418.0	905.70	464.0	952.30		
419.0	906.70	465.0	953.30		
420.0	907.75	466.0	954.30		
421.0	908.75	467.0	955.30		
422.0	909.75	468.0	956.30		
423.0	910.80	469.0	957.30		
424.0	911.80	470.0	958.35		
425.0	912.80	471.0	959.35		
426.0	913.85	472.0	960.35		
427.0	914.85	473.0	961.35		
428.0	915.85	474.0	962.35		
429.0	916.90	475.0	963.35		

This page intentionally left blank.

SECTION 4

MAINTENANCE

4.1 GENERAL

This section contains information on spare parts and procedures for receiving factory assistance in making repairs.

4.2 MAINTENANCE

Both the transmitter and the sensor for the Model 415 and Model 415R exhibit very good long-term stability. As a result, it is not recommended that the transmitter be readjusted in normal usage. Under no circumstances should adjustments be made without the proper test equipment (ref. section 3.2.1). The unit should be returned to the factory for repair since the electronics in the transmitter are potted. It is not possible to repair either the electronics or the sensor in the field.

The standard Daniel warranty applies (ref. Warranty on the inside of the front cover of this manual).

4.3 RECOMMENDED SPARE PARTS

- Daniel recommends a complete assembly of either the Model 415 or the Model 415R as required; or,
- Since sensor probes, electronic modules, and range resistors are all interchangeable (if the transducer is recalibrated), Daniel recommends any quantity or combination of these parts the customer deems necessary.

4.4 CUSTOMER PROBLEM REPORT

A Customer Problem Report is included at the back of this manual. Completely fill out this report and include it with the unit in the shipping container.

4.5 SHIPPING INSTRUCTIONS

Surround the unit with two or three inches of shock absorbing material and pack it in a carton or box. Ship prepaid via the most suitable method.

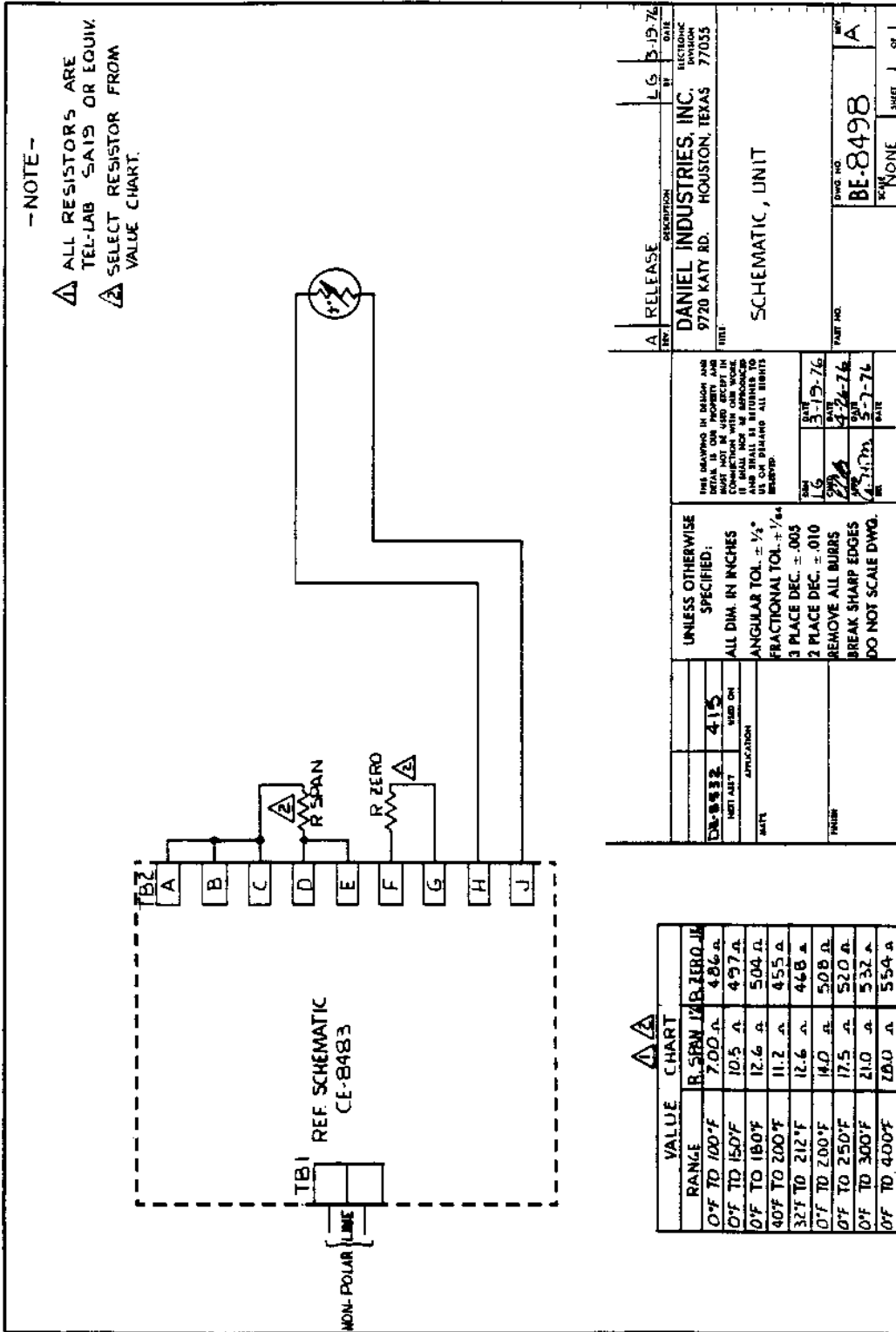
This page intentionally left blank.

APPENDIX A


DRAWINGS AND SPARE PARTS LISTS

BE-8498	Model 415 Schematic, unit
BE-8508	Model 415R Schematic, unit
BE-8530	Model 415 Field wiring diagram
BE-8540	Model 415R Field wiring diagram
BE-8541	Model 415R Outline and Dimension
SP-8532	Model 415 Spare Parts List
SP-8542	Model 415R Spare Parts List

This page intentionally left blank.



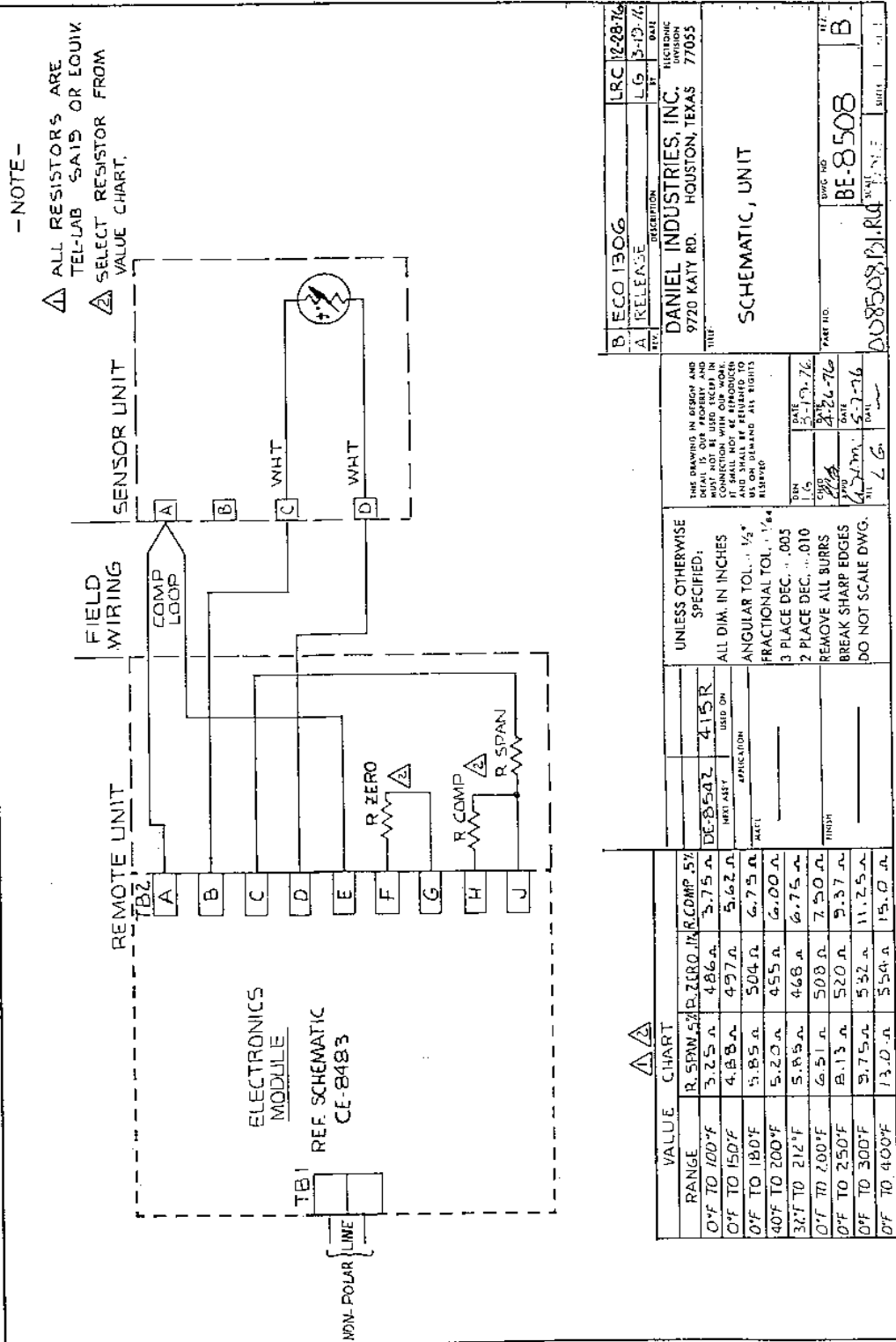
This page intentionally left blank.

<div style="border: 1px dashed black; padding: 10px; margin: 0 auto; width: 80%;"> <p style="text-align: center;">ELECTRONICS MODULE</p> <div style="display: flex; justify-content: center; align-items: center; margin: 10px 0;"> <div style="text-align: center;">NON-POLAR</div>  </div> <p style="text-align: center;">REF. SCHEMATIC BE-849B</p> </div>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center;">DATE</td> <td style="width: 15%; text-align: center;">BY</td> <td style="width: 15%; text-align: center;">DATE</td> <td style="width: 15%; text-align: center;">BY</td> <td style="width: 15%; text-align: center;">DATE</td> <td style="width: 15%; text-align: center;">BY</td> </tr> <tr> <td style="text-align: center;">4-14-76</td> <td style="text-align: center;">LG</td> <td style="text-align: center;">4-14-76</td> <td style="text-align: center;">LG</td> <td style="text-align: center;">4-14-76</td> <td style="text-align: center;">LG</td> </tr> </table>	DATE	BY	DATE	BY	DATE	BY	4-14-76	LG	4-14-76	LG	4-14-76	LG												
DATE	BY	DATE	BY	DATE	BY																				
4-14-76	LG	4-14-76	LG	4-14-76	LG																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;">DRAWING NO.</td> <td style="width: 10%; text-align: center;">REV.</td> <td style="width: 10%; text-align: center;">DATE</td> <td style="width: 10%; text-align: center;">BY</td> <td style="width: 10%; text-align: center;">DATE</td> <td style="width: 10%; text-align: center;">BY</td> </tr> <tr> <td style="text-align: center;">DE-8532</td> <td style="text-align: center;">415</td> <td style="text-align: center;">4-14-76</td> <td style="text-align: center;">LG</td> <td style="text-align: center;">4-14-76</td> <td style="text-align: center;">LG</td> </tr> </table>	DRAWING NO.	REV.	DATE	BY	DATE	BY	DE-8532	415	4-14-76	LG	4-14-76	LG	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center;">DRAWING NO.</td> <td style="width: 15%; text-align: center;">REV.</td> <td style="width: 15%; text-align: center;">DATE</td> <td style="width: 15%; text-align: center;">BY</td> <td style="width: 15%; text-align: center;">DATE</td> <td style="width: 15%; text-align: center;">BY</td> </tr> <tr> <td style="text-align: center;">BE-8530</td> <td style="text-align: center;">A</td> <td style="text-align: center;">4-14-76</td> <td style="text-align: center;">LG</td> <td style="text-align: center;">4-14-76</td> <td style="text-align: center;">LG</td> </tr> </table>	DRAWING NO.	REV.	DATE	BY	DATE	BY	BE-8530	A	4-14-76	LG	4-14-76	LG
DRAWING NO.	REV.	DATE	BY	DATE	BY																				
DE-8532	415	4-14-76	LG	4-14-76	LG																				
DRAWING NO.	REV.	DATE	BY	DATE	BY																				
BE-8530	A	4-14-76	LG	4-14-76	LG																				
<p style="text-align: center;">UNLESS OTHERWISE SPECIFIED:</p> <p>ALL DIM. IN INCHES</p> <p>ANGULAR TOL. $\pm 1/2^\circ$</p> <p>FRACTIONAL TOL. $1/64$</p> <p>3 PLACE DEC. $\pm .005$</p> <p>2 PLACE DEC. $\pm .010$</p> <p>REMOVE ALL BURRS</p> <p>BREAK SHARP EDGES</p> <p>DO NOT SCALE DWG.</p>	<p style="text-align: center;">THIS DRAWING IS DESIGN AND DATA IS OUR PROPERTY AND SHALL NOT BE USED EXCEPT IN CONNECTION WITH OUR JOINT AGREEMENT WITH YOU. IT IS TO BE RETURNED TO US ON DEMAND. ALL RIGHTS RESERVED.</p>																								
<p style="text-align: center;">ELECTRONICS MODULE</p>	<p style="text-align: center;">FIELD WIRING DIAG.</p> <p style="text-align: center;">TEMP. TRANSDUCER</p>																								
<p style="text-align: center;">DANIEL INDUSTRIES, INC.</p> <p style="text-align: center;">9720 KATY RD. HOUSTON, TEXAS 77055</p>	<p style="text-align: center;">DANIEL INDUSTRIES, INC.</p> <p style="text-align: center;">9720 KATY RD. HOUSTON, TEXAS 77055</p>																								
<p style="text-align: center;">ELECTRONIC DIVISION</p>	<p style="text-align: center;">ELECTRONIC DIVISION</p>																								

This page intentionally left blank.

MODEL 415 AND 415R TEMPERATURE TRANSDUCERS

JUL 1997



BE-8508
A RELEASE

Daniel Industries, Inc.
9770 Katy Rd. Houston, Texas 77055

DATE 5-17-76
BY [Signature]
CHECKED [Signature]

DRG NO. BE-8508
REV. 1

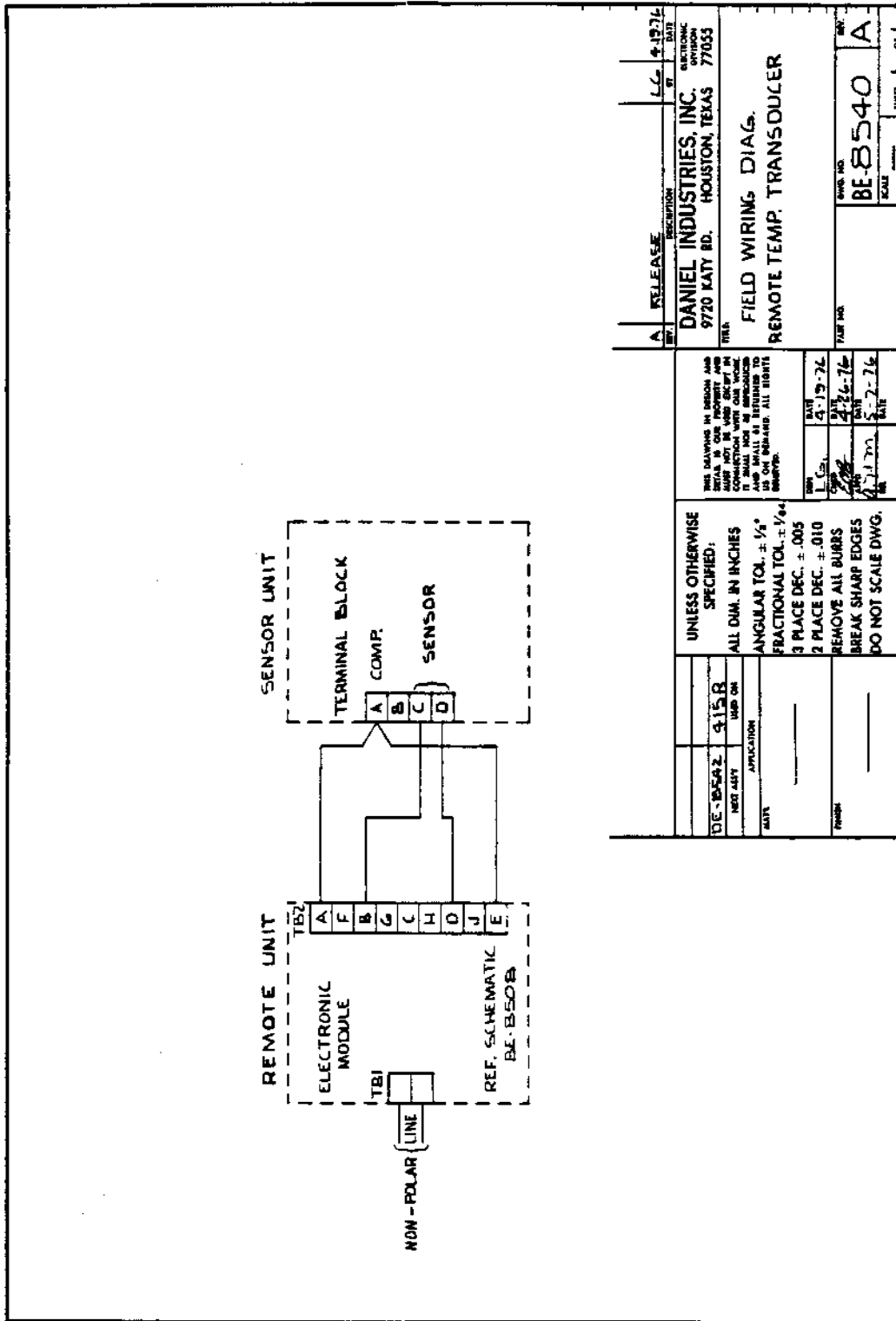
SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED:
ALL DIM. IN INCHES
ANGULAR TOL. $\pm 1/2^\circ$
FRACTIONAL TOL. ± 0.005
3 PLACE DEC. ± 0.010
2 PLACE DEC. ± 0.010
REMOVE ALL BURRS
BREAK SHARP EDGES
DO NOT SCALE DWG.

DATE 5-17-76
BY [Signature]
CHECKED [Signature]

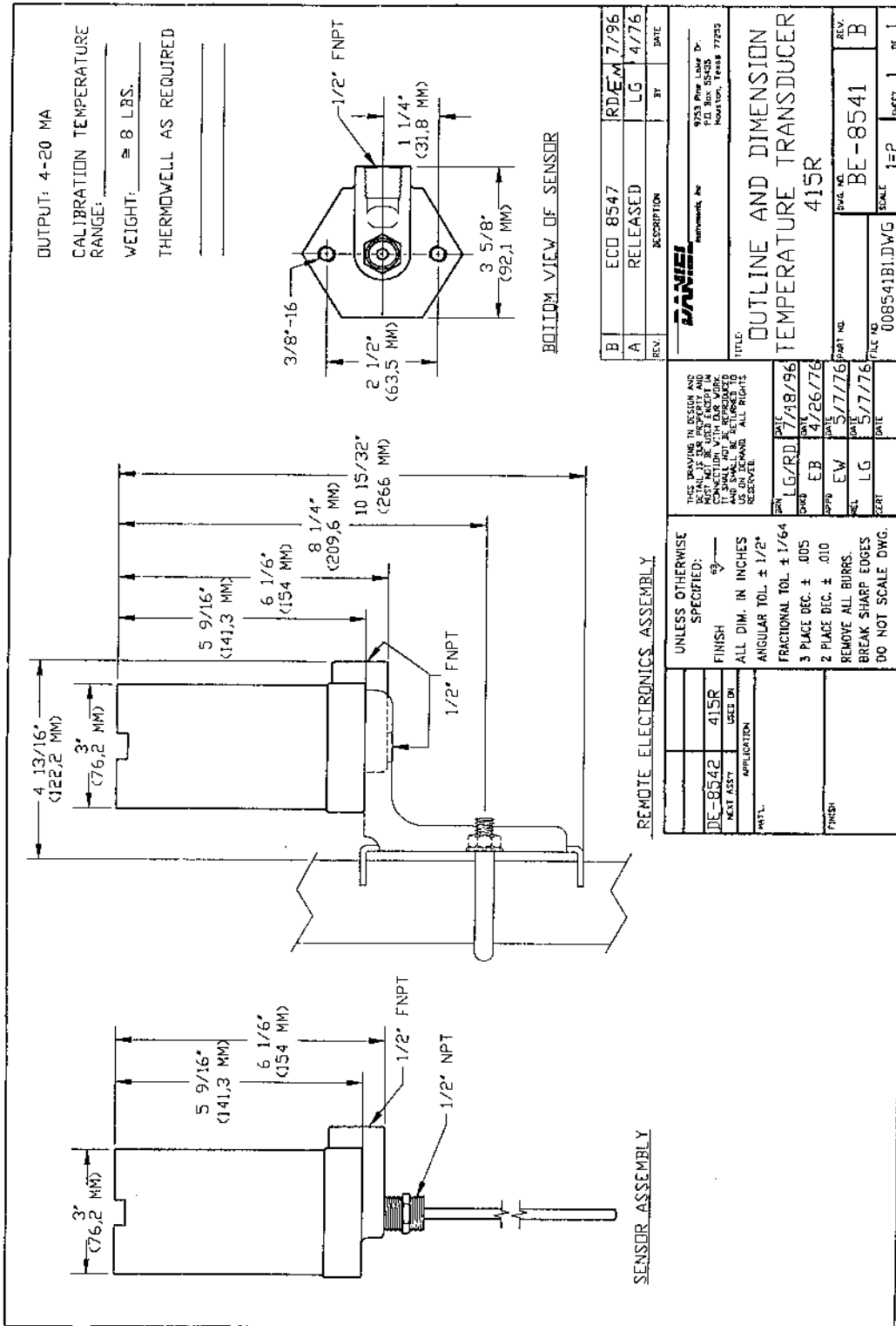
VALUE	CHART
RANGE	R. SPAN, R. ZERO, IMP. COMP. 5%
0°F TO 100°F	3.25 Ω, 4.86 Ω, 5.75 Ω
0°F TO 150°F	4.88 Ω, 4.97 Ω, 5.62 Ω
0°F TO 180°F	5.85 Ω, 5.04 Ω, 6.75 Ω
40°F TO 200°F	5.20 Ω, 4.55 Ω, 6.00 Ω
32°F TO 212°F	5.85 Ω, 4.68 Ω, 6.75 Ω
0°F TO 250°F	6.51 Ω, 5.08 Ω, 7.50 Ω
0°F TO 300°F	8.13 Ω, 5.20 Ω, 9.37 Ω
0°F TO 400°F	13.0 Ω, 5.32 Ω, 11.25 Ω, 15.0 Ω

This page intentionally left blank.



UNLESS OTHERWISE SPECIFIED: ALL DIM. IN INCHES ANGULAR TOL. ± 1/8° FRACTIONAL TOL. ± 1/40 3 PLACE DEC. ± .005 2 PLACE DEC. ± .010 REMOVE ALL BURRS BREAK SHARP EDGES DO NOT SCALE DWG.		THIS DRAWING IS UNLESS AND SHALL NOT BE USED WITHOUT THE CONSULTATION WITH OUR WORK AND SHALL BE RETURNED TO US ON DEMAND. ALL RIGHTS RESERVED.	
DATE	4-19-76	DATE	4-19-76
BY	[Signature]	DATE	4-19-76
BY	[Signature]	DATE	4-19-76
DIE-B542 415R PART JUST USED ON		RELEASE BY LC 4-19-76 DATE	
APPLICATION		DESCRIPTION DANIEL INDUSTRIES, INC. 9720 KATY RD. HOUSTON, TEXAS 77055	
PART NO.		DRAWING NO. BE-8540	
FINISH		SCALE	
SHEET NO.		SHEET 1 OF 1	
TITLE FIELD WIRING DIAG. REMOTE TEMP. TRANSDUCER		DRAWING NO. BE-8540	

This page intentionally left blank.



This page intentionally left blank.

MODEL 415 AND 415R TEMPERATURE TRANSDUCERS

JUL 1997

PROPOSAL _____
 DATE _____
 P.O. _____
 S.O. _____

**RECOMMENDED SPARE PARTS
 ELECTRONIC PRODUCTS**

DANIEL INDUSTRIES, INC.
 Flow Products Division
 9720 Katy Road P.O. Box 19097 Houston, Texas 77024
 DAN-868 (ED-1051)

ITEM	QUAN.	MODEL NUMBER	PART NUMBER	DESCRIPTION	UNIT PRICE	TOTAL NET
		415		Select per unit dash number (Found on tag on rear of instrument)		1
1				Sensor Assembly		2
	1		3-0415-300	M=3-1/4 in. Fixed Sensor		3
	1		3-0415-301	M=5-1/4 in. Fixed Sensor		4
	1		3-0415-302	M=8-1/4 in. Fixed Sensor		5
	1		3-0415-303	M=11-1/4 in. Fixed Sensor		6
	1		3-0415-304	M=14-1/4 in. Fixed Sensor		7
	1					8
	1					9
	2		3-0415-305	M= 3-1/4 in. Removable Sensor		10
	2		3-0415-306	M= 5-1/4 in. Removable Sensor		11
	2		3-0415-307	M= 8-1/4 in. Removable Sensor		12
	2		3-0415-308	M=11-1/4 in. Removable Sensor		13
	2		3-0415-309	M=14-1/4 in. Removable Sensor		14
						15
						16
				M=length of sensor below threads, spring compressed for removable sensors.		17
						18
						19
						20
						21

TITLE		RECOMMENDED SPARE PARTS 415	
DRN.	DATE	MODEL NO.	TOTAL
NZ	6/19/78	415	
CHD.		TOP ASSY.	
APPRD.	DATE	NEXT ASSY.	
MZ	6/19/78		
PART NO.			SP - 8532
REV.	ECO. NO.	DATE	BY
A			

This page intentionally left blank.

MODEL 415 AND 415R TEMPERATURE TRANSDUCERS.

JUL 1997

ITEM	QUAN.	MODEL NUMBER	PART NUMBER	DESCRIPTION	UNIT PRICE	TOTAL NET
		415	---	Continued		
2	1	1	3-0415-111	Electronic Module, 4-20 mA*		
	1	2	3-0415-111	0 to 100 ⁰ F		
	1	3	3-0415-111	0 to 150 ⁰ F		
	1	4	3-0415-111	0 to 180 ⁰ F		
	1	5	3-0415-111	0 to 200 ⁰ F		
	1	6	3-0415-111	0 to 250 ⁰ F		
	1	7	3-0415-111	0 to 300 ⁰ F		
	1	8	3-0415-111	0 to 400 ⁰ F		
	1	9	3-0415-111	32 to 212 ⁰ F		
	1	9	3-0415-111	40 to 200 ⁰ F		
				*Indicate temperature coefficient 1.0%, 0.5% or 0.3% per 100 ⁰ F		
				NOTE: An X in the model number signifies special model--consult factory.		

TITILE		RECOMMENDED SPARE PARTS		TOTAL	
415		415		415	
DRN.	DATE	MODEL NO.	DATE	TOP ASBY.	DATE
NZ	6/9/78	415	6/13/78		
APPV'D.	DATE	DATE	DATE	DATE	DATE
M.S.	6/13/78				
PAR. NO.		PAR. NO.			
		SP-8532			
				SH 2	OF 2

DANIEL
INDUSTRIES, INC.
Flow Products Division
9720 Katy Road P.O. Box 19097
Houston, Texas 77024
DAN-388 (ED-105)

PROPOSAL
DATE
P.O.
S.O.

RECOMMENDED SPARE PARTS
ELECTRONIC PRODUCTS

This page intentionally left blank.

MODEL 415 AND 415R TEMPERATURE TRANSDUCERS

JUL 1997

DANIEL INDUSTRIES, INC.
 Flow Products Division
 9720 Katy Road P.O. Box 19097 Houston, Texas 77024
 DAN-368 (EO-105)

RECOMMENDED SPARE PARTS
 ELECTRONIC PRODUCTS

PROPOSAL _____
 DATE _____
 P.O. _____
 S.O. _____

ITEM	QUAN.	MODEL NUMBER	PART NUMBER	DESCRIPTION	UNIT PRICE	TOTAL NET
		415R		Select per unit dash number		1
1	1		3-0415-300	Sensor Assembly		2
	1		3-0415-301	M= 3-1/4 in. Fixed Sensor		3
	1		3-0415-302	M= 5-1/4 in. Fixed Sensor		4
	1		3-0415-303	M= 8-1/4 in. Fixed Sensor		5
	1		3-0415-304	M= 11-1/4 in. Fixed Sensor		6
	1		3-0415-304	M= 14-1/4 in. Fixed Sensor		7
	1	2	3-0415-305	M= 3-1/4 in. Removable Sensor		8
	1	2	3-0415-306	M= 5-1/4 in. Removable Sensor		9
	1	2	3-0415-307	M= 8-1/4 in. Removable Sensor		10
	1	2	3-0415-308	M= 11-1/4 in. Removable Sensor		11
	1	2	3-0415-309	M= 14-1/4 in. Removable Sensor		12
				M=length of sensor below threads, spring compressed for removable sensors.		13
						14
						15
						16
						17
						18
						19
						20
						21

TITLE		RECOMMENDED SPARE PARTS		TOTAL	
415R		415R		415R	
DRN.	DATE	MODEL NO.	DATE	TOP ASSEY.	DATE
NZ	6/9/78	415R	6/9/78		6/13/78
CHD.					
APPROV.	DATE	DATE	DATE	DATE	DATE
M.P.	6/13/78				
PAPER NO.					
REV.	ECO. NO.	DATE	BY	SP - 8542	
A				SH. 1	OF 2

This page intentionally left blank.

MODEL 415 AND 415R TEMPERATURE TRANSDUCERS

JUL 1997

DANIEL INDUSTRIES, INC.
 Flow Products Division
 9720 Katy Road P.O. Box 19087 Houston, Texas 77024
 DAN-368 (ED-105)

RECOMMENDED SPARE PARTS
 ELECTRONIC PRODUCTS

PROPOSAL
 DATE
 P.O.
 S.O.

ITEM	QUAN.	MODEL NUMBER	PART NUMBER	DESCRIPTION	UNIT PRICE	TOTAL NET
		415R----	-----	Continued		
2	1		3-0415-112	Electronic Module, 4-20 mA*		
	1		3-0415-112	0 to 100°F		
	1		3-0415-112	0 to 150°F		
	1		3-0415-112	0 to 180°F		
	1		3-0415-112	0 to 200°F		
	1		3-0415-112	0 to 250°F		
	1		3-0415-112	0 to 300°F		
	1		3-0415-112	0 to 400°F		
	1		3-0415-112	32 to 212°F		
	1		3-0415-112	40 to 200°F		
				*indicate temperature coefficient 1.0%, 0.5% or 0.3% per 100°F		
				NOTE: An X in the model number signifies special model--consult factory.		

DRN.	DATE	MODEL NO.	TOTAL
NZ	6/9/78	415R	
CHD.	DATE	TOP ASSY.	
APPRD.	DATE	NEXT ASSY.	
M.S.	6/13/78		
PAR. NO.			
REV.	ECO. NO.	DATE	BY
A			
RECOMMENDED SPARE PARTS			SP - 8542
415R			SH 2 OF 2

This page intentionally left blank.

WARRANTY CLAIM REQUIREMENTS

To make a warranty claim, you, the Purchaser, must:

1. Provide Daniel with proof of the Date of Purchase and proof of the Date of Shipment of the product in question.
2. Return the product to Daniel within twelve (12) months of the date of original shipment of the product, or within eighteen (18) months of the date of original shipment of the product to destinations outside of the United States. The Purchaser must prepay any shipping charges. In addition, the Purchaser is responsible for insuring any product shipped for return, and assumes the risk of loss of the product during shipment.
3. To obtain Warranty service or to locate the nearest Daniel office, sales, or service center call (713) 467-6000, Fax (281) 897-2901, or contact:

Daniel Instruments, Inc.
P. O. Box 55435
Houston, Texas 77255

When contacting Daniel for product service, the purchaser is asked to provide information as indicated on the following "Customer Problem Report".

Daniel Instruments, Inc. offers both on call and contract maintenance service designed to afford single source responsibility for all its products.

Daniel Industries, Inc. reserves the right to make changes at any time to any product to improve its design and to insure the best available product.

**DANIEL INDUSTRIES, INC.
CUSTOMER PROBLEM REPORT**

FOR FASTEST SERVICE, COMPLETE THIS FORM, AND RETURN IT ALONG WITH THE AFFECTED EQUIPMENT TO CUSTOMER SERVICE AT THE ADDRESS INDICATED BELOW.

COMPANY NAME: _____

TECHNICAL CONTACT: _____ PHONE: _____

REPAIR P. O. #: _____ IF WARRANTY, UNIT S/N: _____

INVOICE ADDRESS: _____

SHIPPING ADDRESS: _____

RETURN SHIPPING METHOD: _____

EQUIPMENT MODEL #: _____ S/N: _____ FAILURE DATE: _____

DESCRIPTION OF PROBLEM: _____

WHAT WAS HAPPENING AT TIME OF FAILURE? _____

ADDITIONAL COMMENTS: _____

REPORT PREPARED BY: _____ TITLE: _____

IF YOU REQUIRE TECHNICAL ASSISTANCE, PLEASE FAX OR WRITE THE MAIN CUSTOMER SERVICE DEPARTMENT AT:

DANIEL INSTRUMENTS, INC.
ATTN: CUSTOMER SERVICE
19203 HEMPSTEAD HIGHWAY
HOUSTON, TEXAS 77065

PHONE: (281) 897-2900
FAX: (281) 897-2901

The sales and service offices of Daniel Industries, Inc. are located throughout the United States and in major countries overseas.
Please contact Daniel Instruments, Inc. at
P. O. Box 55435, Houston, Texas 77255, or phone (713) 467-6000
for the location of the sales or service office nearest you.
Daniel Instruments, Inc. offers both on-call and contract
maintenance service designed to provide single-source
responsibility for all Daniel Instruments, Inc. Products.

Daniel Instruments, Inc. reserves the right to make changes to any of its products or services at any time without prior notification in order to improve that product or service and to supply the best product or service possible.

DANIEL

Instruments, Inc.