From:	Iantorno, Randy F
To:	Hoc, HOO X
Cc:	Miller, Craig; Sablotsky, Shane; Johnson, Todd D; Pierce, Justin T (WLS)
Subject:	[External_Sender] 10 CFR Part 21 Reporting of Defects for Introl Positioner 890265-010 - CW SAS Initial Report No. 10CFR21-48
Date:	Friday, June 07, 2019 3:37:57 PM
Attachments:	10 CFR Part 21 Reporting of Defects for Introl Positioner 890265-010.pdf

Dear NRC Operations Center,

A notification was given to the NRC by Paragon dated May 31, 2019.

Because of this there are two actions for Curtiss-Wright Steam Air Solutions (SAS).

1) Curtiss-Wright SAS (Formerly Dresser-Rand) has 5 business days from May 31st, 2019 to notify individual customers of this issue. This notification is attached as CW SAS Initial Report No. 10CFR21-48. A separate email is being sent to the end users to advise them of this report.
2) Curtiss-Wright SAS (Formerly Dresser-Rand) has a maximum of 30 business days from May 31st, 2019 to provide final findings to the notified customers.

Please reply to me to acknowledge receipt of this notice.

Please call or email me anytime if you need more information.

Thanks in advance and have a great day/weekend.

Randy F. Iantorno
Project Manager, Government Aftermarket

SAS, EMS Division
Curtiss-Wright
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Date: June 7, 2019

NRC Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: 10 CFR Part 21 Reporting of Defects for Introl Positioner 890265-010

To whom it may concern:

The attached initial reports from Paragon Energy Solutions (PES) and Curtiss-Wright SAS (CW SAS) are intended to inform the NRC and affected customers of a potential defect related to Introl Positioner, CW SAS part no. 890265-010, installed as part of the CW SAS Electronic Governor Speed Control System (EGSCS).

Shearon Harris Nuclear Plant experienced an overspeed trip of the Turbine Driven Auxiliary Feedwater Pump (TDAFW) on January 18, 2019 during routine system testing. Upon receipt of the initial start signal, the valve remained in the fully open position causing the TDAFW to trip on overspeed. Investigation into the overspeed trip revealed the positioner was not controlling the actuator properly in response to the governor command signal. This situation and subsequent troubleshooting led to replacement with the site spare positioner. Once installed, the system responded as expected and the suspect positioner was sent to Curtiss-Wright SAS for evaluation.

In a joint effort between CW SAS and PES, the positioner was tested and evaluated to determine the cause of the failure. The attachments listed below describe the defect, probable cause and provide testing recommendations until a path forward and final resolution are determined.

- CW SAS Initial Report No. 48
- PES report dated May 31, 2019
- 890265-TEST

Sincerely,

Todd Johnson
Mgr., Aftermarket Government. Engineering
Curtiss-Wright SAS

INITIAL REPORT 10CFR PART 21
REPORT OF A POTENTIAL SAFETY HAZARD

Prepared by:	Todd Johnson	Date:	June 6, 2019
		File No:	F38483A
Title:	Mgr., Aftermarket Government. Engineering Curtiss-Wright SAS	Serial No:	T38483A
		Type:	GS-2
		Part No:	890265-010
Part Name:	Introl Positioner (890265-010)	Dwg. No:	890265
		Rev. Level:	L

(i) Name and address of the individual or individuals informing the Commission

Todd Johnson, Mgr., Aftermarket Government. Engineering

(ii) Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains defect

Basis Component: Introl Positioner, Curtiss-Wright SAS (CW SAS) Part No. 890265-010

Facility where failure occurred:

- Duke Energy / Shearon Harris

Additional facilities with potential defect

- Alabama Power Farley
- Southern California Edison - SONGS
- Cooper / NPPD
- CNAT / Almaraz
- Clinton
- Wolf Creek
- NEXTERA ENERGY Point Beach
- Georgia Power Hatch
- Tennessee Valley Authority

(iii) Identification of the firm constructing the facility or supplying the basic component which falls to comply or contains a defect.

Supplier/Dedicator: Paragon Energy Solutions, LLC
777 Emory Valley Road
Oak Ridge, TN 37830

(iv) Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.

Internal corrosion discovered inside Texas Instruments (TI) model TL084N Operational Amplifier chips on the SL3EX Controller Board inside the Introl positioner resulted in the positioner failing. There are a total of three TI TL084N chips located on the controller board. There is indication the cause of corrosion resulted from delamination during the initial fabrication/soldering process of the board. Delamination allows possible ingress of solder flux into the chip. The investigation is ongoing and the findings are preliminary at this point. Refer to PES 10 CFR Part 21 Report dated May 31, 2019 for more specific details.

This failure resulted in a loss of steam turbine speed control capability and caused the Turbine Driven Auxiliary Feedwater (TDAFW) Pump to trip on overspeed.

(v) The date on which the information of such defect or failure to comply was obtained.

Curtiss-Wright SAS was notified of the positioner failure on January 23, 2019.

(vi) In the case of a basic component which contains a defect or fails to comply, the number and location of these components in use at, supplied for, being supplied for, or may be supplied tor, manufacture, or being manufactured for one or more facilities or activities subject to the regulations in this part.

Figure 1 below identifies sites where positioners were provided.

(vii) The corrective action which has been is being, or will be taken: the name of the individual or organization responsible for the action: and the length of time that has been or will be taken to complete the action.

- The three TI chips on the affected board have been successfully replaced at Paragon Energy Systems (PES). The repaired positioner will be configured and returned to Shearon Harris.
- The evaluation of suspect chips has been limited to those removed from the failed positioner, along with some supplied to PES by CW SAS. Work is ongoing in this area.
- A complete list of potentially affected installations is listed in Figure 1 below and in the PES Part 21 Report dated May 31, 2019.
- Although this defect has the potential of preventing the Electronic Governor Speed Control System (EGSCS) from performing its intended safety function, it does not prevent the Terry Steam Turbine from operating. If the EGSCS fails, the turbine can be operated manually using the Trip and Throttle Valve (TTV) to control speed by regulating steam flow to the turbine.
- Steps are being taken to develop a plan to replace chips on affected positioner boards. This is still in the preliminary stages and specific recommendations will follow.

Figure 1: Affected sites with potentially affected positioners

Client / End User	3rd Party Engineering Firm	Description - HPCI/RCIC Aux	Turbine Serial No.	CW SAS Project No.	Shipment Year	Installed / Commissioned
Alabama Power Farley	Bechtel	GS-2 - Aux	37858A	343670	Jan-08	May-10
Alabama Power Farley	Bechtel	GS-2 - Aux	37858B	343670	Jan-08	May-10
Southern California Edison - SONGS	Bechtel	GS-2 - Aux	40101A	375259	June-09	Jan-10
Southern California Edison - SONGS	Bechtel	GS-2 - Aux	40101B	375259	Jun-09	Jan-10
Cooper / NPPD	Engineering Solutions	GS-1 RCIC	35939A	478937	Sep-15	Oct-18
CNAT / Almaraz		GS-2 - Aux	38467A	501197	Mar-15	Jul-17
CNAT / Almaraz		GS-2 - Aux	38467B	501197	Mar-15	Jan-17
Clinton	Engineering Solutions	GS-2 RCIC	38187A	513114	Dec-12	TBD
Duke Energy / Shearon Harris	Engineering Solutions	GS-2 - Aux	41056A	C34778	Dec-14	Oct-16
Wolf Creek	Hurst Technologies	GS-2 - Aux	40177A	C34590	Decr-12	Mar-13
NEXTERA ENERGY Point Beach	Sargent Lundy	GS-2 - Aux	D6729	C34587	Sep-13	Sep-14
NEXTERA ENERGY Point Beach	Sargent Lundy	GS-2 - Aux	D6730	C34587	Sep-13	Sep-14
Georgia Power Hatch	Bechtel	GS-1 RCIC	36681A	142513	Mar-16	TBD
Georgia Power Hatch	Bechtel	GS-1 RCIC	37121A	142513	Mar-16	TBD
Tennessee Valley Authority WB-1	Engineering Solutions	GS-2 AUX	38677A	146320	Jan-17	April-17
Tennessee Valley Authority WB-2	Engineering Solutions	GS-2 AUX	38677B	146320	May-17	Nov-17
Tennessee Valley Authority SQ-1	Engineering Solutions	GS-2 AUX	37480A	160361	Aug-18	October-19 (Scheduled)
Tennessee Valley Authority SQ-1	Engineering Solutions	GS-2 AUX	37480B	160361	Sep-18	April-20 (Scheduled)

(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or wilt be given to purchasers or licensees.

- Until a solution is finalized, increased monitoring and system testing is recommended. Test procedure 890265-TEST has been developed to evaluate positioner functionality and determine if performance is degrading. Test instructions and acceptance criteria are included
- On an individual plant basis, Curtiss-Wright SAS does not have the capability to complete the 10CFR Part 21 evaluation to determine if the condition would result in a substantial safety hazard. This notification provides notification of the potential defect so sites can evaluate their individual situations.

Evaluation/Recommendation Prepared By: Todd Johnson
Title: Mgr., Aftermarket Govt. Engineering Date: June 6, 2019
Approved By: Todd Johnson
Title: Mgr., Aftermarket Govt. Engineering Date: June 6, 2019

DISPOSITION, CHECK ONE:

[X] Yes, this constitutes a safety hazard and requires a Final Report be prepared (NNSOP12001F1)

[ ] No, this does not constitute a safety hazard and does not require any further reporting.

Reviewed by Curtiss-Wright SAS General Manager:

Signature: Mary K Workoll
Title: General Manager Date: 6/7/19

RETURN TO RESPONSIBLE NUCLEAR PRODUCT ENGINEERING MANAGER

May 31, 2019

Document Control Center
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: 10 CFR Part 21 Report of Defect GS2 Terry Turbine Introl Positioners

To whom this may concern:

a) Individual informing NRC and address:
Ray Chalifoux
Paragon Energy Solutions LLC
777 Emory Valley Road
Oak Ridge, TN 37830

b) Basic component supplied which contains a defect:
GS2 Terry Turbine Introl Positioners P/N: 890265-010

c) Supplier of the Basic Component:
ATC-Nuclear (now Paragon Energy Solutions, LLC)

d) Nature of defect:
Introl Positioners used by stations in GS2 Terry Turbine control applications have the potential to contain a latent defect. The defect is the result of internal corrosion which has been identified in TI Operational Amplifiers Part No.TL084CN on the SL3EX Controller Boards of the turbine throttle valve positioner. It is believed the likely cause is associated with the ingress of solder flux into the IC Chip package on the controller board due to delamination caused by the soldering process during fabrication. The corrosion over time can result in intermittent open circuiting and high resistance in the aluminum metallization. Chlorine ionic contamination can also result in high leakage currents within the component circuitry. Failures may be manifested by a reduced valve position signal disproportional to the expected demand condition, no actuation signal i.e. throttle valve remaining full open, or other anomalous unexpected behavior. There are three TL084CN chips on each SL3EX Controller Board within the positioner assembly. There have been two documented failures to date occurring in 2015 and 2019 in installed systems.

e) Date determination made:
May 29, 2019

f) Number and location of these components:
Attachment 1 identifies positioners provided to stations. Positioners provided to Farley Station and SONGS were not dedicated by ATC-Nuclear.

g) Corrective action taken:
Paragon Energy Solutions replaced the TL084CN Chips on the failed positioner as directed by Curtiss-Wright SAS and the Licensee. Curtiss-Wright SAS has identified the list of Introl Positioners provided to licensees.

h) Any advice related to the defect:
Licensees should coordinate through Curtiss-Wright SAS (formerly Dresser Rand) to implement repair strategies.

Additional Background

ATC-Nuclear (now Paragon Energy Solutions) originally dedicated 35 Introl assemblies from 2011 to 2013 for Dresser Rand (now Curtiss-Wright SAS) as part of a terry turbine digital control system upgrade utilizing the Introl Positioner product line. Recently, Paragon was contracted by Curtiss-Wright SAS under Purchased Order 17029549 to evaluate a Shearon Harris positioner failure. Two units were provided to Paragon under the purchase order listed above for evaluation. The licensee assembly, S/N 01046M13, was installed and had been in service at the station since October 2016. This unit failed prompting this evaluation. Following identification of the failure as described above, corrosion internal to other TL084CN Chip packages in the second positioner provided by Curtiss-Wright SAS was identified. This positioner, however, did not fail and continued to operate normally. A previous failure of a TL084CN Chip was also identified in 2015.

The analyses and evaluations performed by Paragon do not consider purchasers and/or licensee application-specific information as it only focuses on the functional performance of the positioner. On this basis, Paragon does not have the capability to complete the 10CFR Part 21 evaluation to determine whether the condition reported could cause a substantial safety hazard. This notification serves to inform purchaser(s) and/or affected licensees of this determination, so they may evaluate the identified condition, pursuant to §10CFR 21.21(a).

Stations are advised to work directly with Curtiss-Wright SAS via the technical contacts below.

Randy F. Iantorno Project Manager, T: 585.596.3831, M: 585.596.9248, email riantorno@curtisswright.com

or

Justin Pierce 585.596.3866, email jpierce@curtisswright.com

Ray Chalifoux

Ray Chalifoux, VP QA - Paragon ES
T: 865.384.0124 or email rchalifoux@paragones.com

Attachment 1: Affected Facilities

Client / End User	3rd Party Engineering Firm	Description - HPCI/RCIC Aux	Turbine Serial #	CW Project #	Shipment Year	Installed / Commisioned
Alabama Power Farley	Bechtel	GS-2 - Aux	37858A	343670	January-08	May-10
Alabama Power Farley	Bechtel	GS-2 - Aux	37858B	343670	January-08	May-10
Southern California Edison - SONGS	Bechtel	GS-2 - Aux	40101A	375259	June-09	January-10
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Cooper / NPPD	Engineering Solutions	GS-1 RCIC	35939A	478937	September-15	October-18
CNAT / Almaraz		GS-2 - Aux	38467A	501197	March-15	July-17
CNAT / Almaraz		GS-2 - Aux	38467B	501197	March-15	January-17
Clinton	Engineering Solutions	GS-2 RCIC	38187A	513114	December-12	To Be Determined
Duke Energy / Shearon Harris	Engineering Solutions	GS-2 - Aux	41056A	C34778	December-14	October-16
Wolf Creek	Hurst Technologies	GS-2 - Aux	40177A	C34590	December-12	March-13
NEXTERA ENERGY Point Beach	Sargent Lundy	GS-2 - Aux	D6729	C34587	September-13	September-14
NEXTERA ENERGY Point Beach	Sargent Lundy	GS-2 - Aux	D6730	C34587	September-13	September-14
Georgia Power Hatch	Bechtel	GS-1 RCIC	36681A	142513	March-16	To Be Determined
Georgia Power Hatch	Bechtel	GS-1 RCIC	37121A	142513	March-16	To Be Determined
Tennessee Valley Authority WB-1	Engineering Solutions	GS-2 AUX	38677A	146320	January-17	April-17
Tennessee Valley Authority WB-2	Engineering Solutions	GS-2 AUX	38677B	146320	May-17	November-17

Tennessee Valley Authority SQ-1	Engineering Solutions	GS-2 AUX	37480A	160361	August-18	October-19 (Scheduled)
Tennessee Valley Authority SQ-1	Engineering Solutions	GS-2 AUX	37480B	160361	September-18	April-20 (Scheduled)

FUNCTIONAL TEST PROCEDURE FOR INTROL POSITIONER PART# 890265-010

Document No.: 890265-TEST
Created By Mark Konieczny
6/7/2019

1.0 Purpose

The purpose of this testing is to ensure proper operability of the Introl Positioner Curtiss-Wright SAS (CW SAS) part # 890265-010.

2.0 Background

Introl Positioners used in nuclear safety related digital governor control systems for Terry GS-1 and GS-2 frame turbines have the potential to contain a latent defect. Further information of this defect can be found on the filing of the 10 CFR Part 21 reporting submitted by Paragon Energy Systems to the NRC on May 31st, 2019 and Curtiss-Wright SAS 10 CFR Part 21 Report 48.

3.0 Equipment

- 4 to 20 current command source such as an Altex Loop Calibrator Model 434KP
- Digital multimeter capable of reading both voltage and current such as Fluke model 115
- Personal Computer (PC) with DR Positioner 890265-010 GUI software installed
- Communications cable capable of communicating to the positioner using RS- 485 protocol
- Exlar Actuator DR part# 890267-001
- Power Cable DR part #890268-701 or equivalent
- Resolver Feedback cable DR part #890268-703 or equivalent
- GS-2 turbine governor valve with actuator adapter bracket or bonnet fixture
- Introl Positioner 890265-010 or 890265-701
- 500 ohm precision resistor
- Switch to be used as an enable switch for the positioner

4.0 Functional Test Procedure

For the following connections refer to Figures 1 and 2 attached and the Installation and Operation manual. Also refer to the ESI site specific schematics. For a copy of schematics, contact CW SAS. If this test is being performed with the positioner installed in a panel, it may be necessary to lift and protect some connections to the Introl positioner.

FUNCTIONAL TEST PROCEDURE FOR INTROL POSITIONER PART# 890265-010

1. Verify power to the system is removed.
2. Connect the power cable and resolver cable connections at both the actuator end and positioner end. This can include filters or not.
3. Connect the RS-485 communications cable from the PC with the Introl GUI installed to TB3-2 (+) and TB3-1 (-). See figure 1.
4. Connect 4 to 20 mA current command source to TB3-11 (+) and TB3-12 (-). See figure 1. If actuator 1 output from the Woodward 505 governor is connected, these wires will have to be lifted first.
5. Connect a jumper from TB1-1 to TB3-4. See figure 1.
6. Connect an enable switch between TB1-6 and TB3-6. Make sure the switch is in the off position. See figure 1.
7. Connect a 500 ohm precision resistor in series with a 24 vdc power supply to TB3-7 (+) and TB3-8 (-) actual position output. Refer to figure 7.11 page 21 of the Installation and Operation manual and figure 2.
8. Ensure the power supply is off. Connect power to TB4-5 (+) and TB4-4 (-).
9. Power up the PC and open the Introl Positioner GUI interface. Refer to Introl Positioner Installation and Operation Manual.
10. Apply power to the Introl positioner. Verify the Power LED illuminates and the fans are running.
11. Using the GUI interface, select the Upload/Download tab. Upload the configuration from the drive to the PC.
12. Change the tab to drive monitor. Select the monitor button to monitor the drive.
13. Using the current command source, apply 4 mA to the command input.
14. Turn on the 24 vdc power supply that is in series with the resistor.
15. Turn the enable switch to on. The actuator should home closing the governor valve (extend).
16. Increment the command signal in 4 mA steps. The resulting position read by the GUI and the voltage across the resistor should match the chart below. It is recommended to use a precision resistor.

mA	Position inches	position min	position max	volts dc	dc volts min	dc volts max
4	.750*	.740	.760	2*	1.893	2.107
8	.563	.553	.573	4	3.893	4.107
12	.375	.365	.385	6	5.893	6.107
16	.188	.178	.198	8	7.893	8.107
20	.000	-.010	.010	10	9.893	10.107

* Note 1 – The value may exceed tolerance if fixture lacks rigidity.

5.0 Conclusions

If the position values fall within acceptable ranges, the positioner is functioning properly. If the values fall outside of the acceptance criteria, the positioner is not functioning properly. Please contact CW SAS for further instructions.

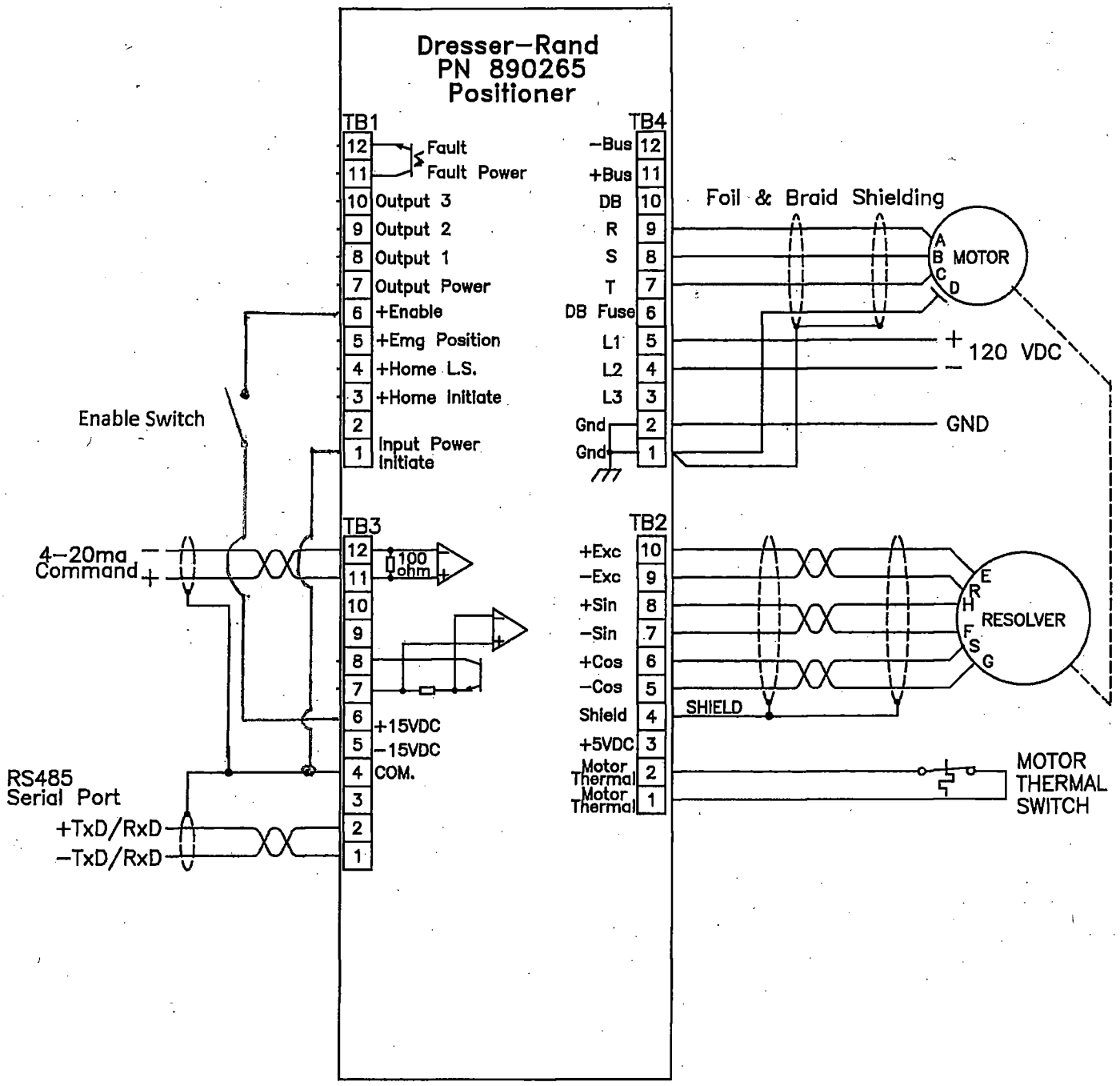

Figure 1

For clarity, not all connections shown. Motor and resolver shown without filter connections.

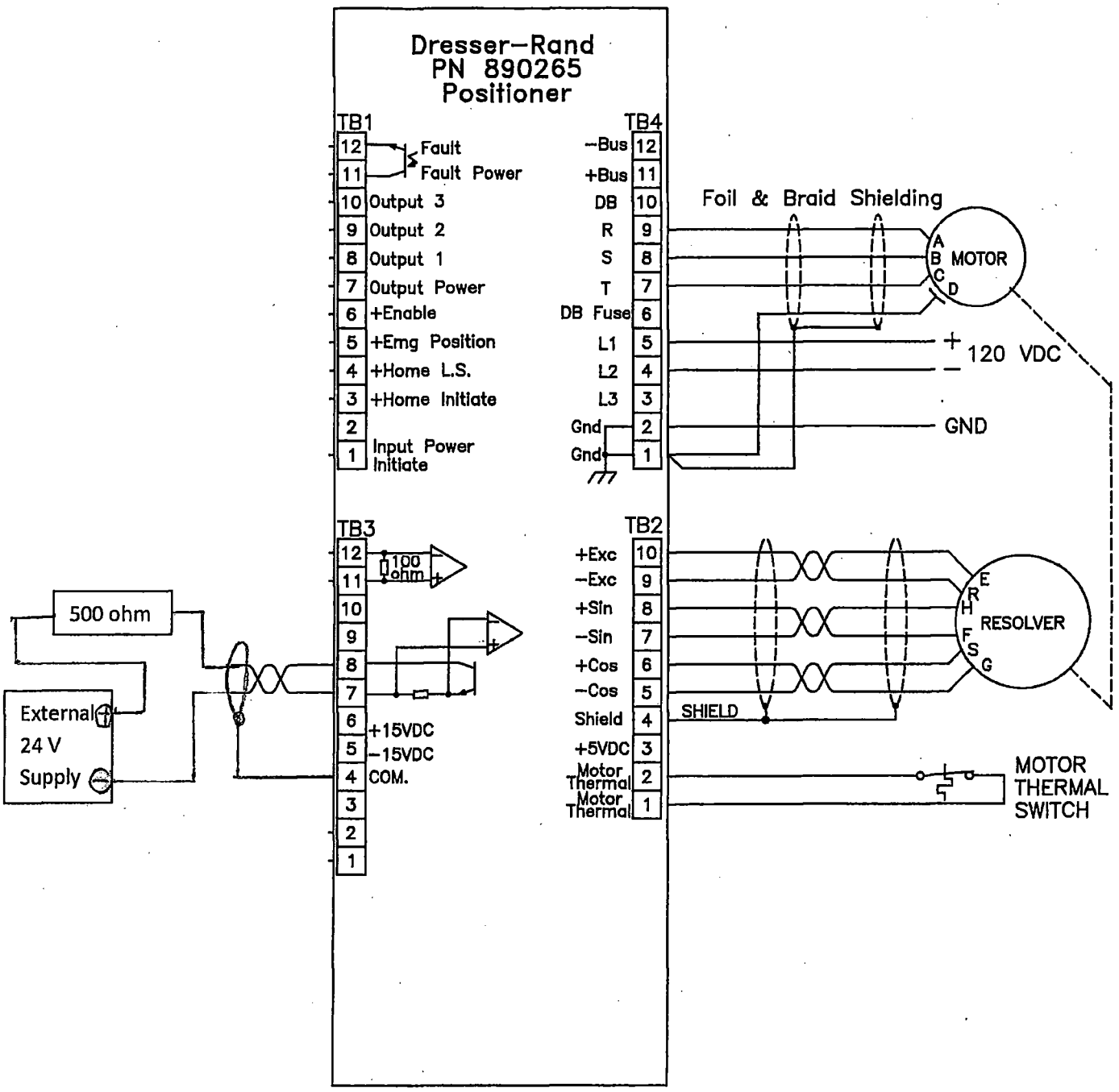

Figure 2

For clarity, not all connections shown. Motor and resolver shown without filter connections.