REPORT NUMBER 124-GTL-07-006

SAFETY COMPLIANCE TESTING FOR FMVSS 124 ACCELERATOR CONTROL SYSTEMS

TOYOTA MOTOR MANUFACTURING CALIFORNIA INC.
2007 TOYOTA TACOMA, TRUCK
NHTSA NO. C75116

GENERAL TESTING LABORATORIES, INC.
1623 LEEDSTOWN ROAD
COLONIAL BEACH, VIRGINIA 22443

NOVEMBER 23, 2007

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVE, SE
WASHINGTON, D.C. 20590

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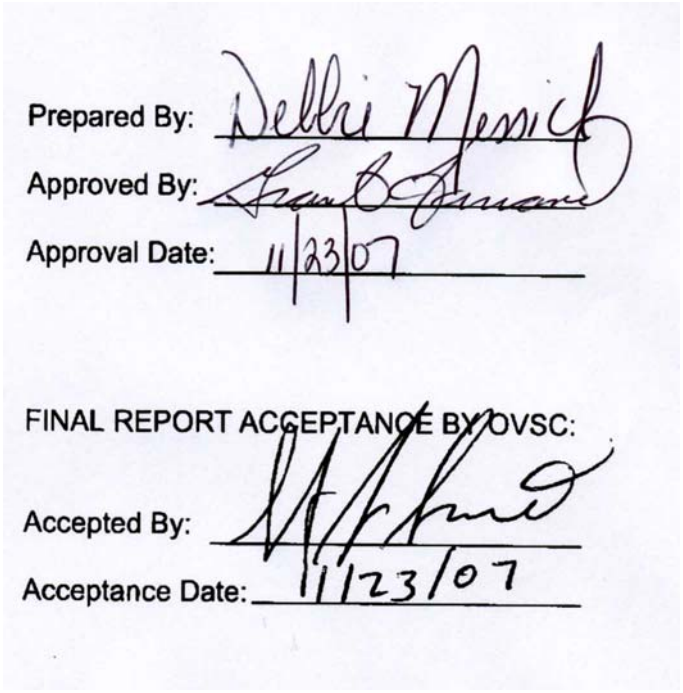

Technical Report Documentation Page

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12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance (NVS-220) 1200 New Jersey Ave., S.E. Washington, DC 20590		13. Type of Report and Period Covered Final Test Report October 29-30, 2007 14. Sponsoring Agency Code NVS-220
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16. Abstract Compliance tests were conducted on the subject 2007 Toyota Tacoma Truck in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-124-06 for the determination of FMVSS 124 compliance. Test failures identified were as follows: None		
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SECTION 1
PURPOSE OF COMPLIANCE TEST

FMVSS 124 specifies requirements for the return of a vehicle's throttle to the idle position when the driver removes the actuating force from the accelerator control, or in the event of a severance or disconnection in the accelerator control system. The purpose of FMVSS 124 is to reduce the number of deaths and injuries resulting from engine overspeed caused by malfunctions in the accelerator control system. This standard applies to passenger cars, multipurpose passenger vehicles (MPV's), trucks and buses.

SECTION 2
TEST PROCEDURES AND DISCUSSION OF RESULTS

Compliance testing was conducted on a 2007 Toyota Tacoma Truck, NHTSA No. C75201 in accordance with the National Highway Traffic Safety Administration (NHTSA) Laboratory Procedure TP-124-06.

The vehicle is equipped with an electronic throttle control system with an Accelerator Pedal Position Senson (APS), a Throttle Plate Position Sensor (TPS), an Electronic control Module (ECM) and an Air Throttle Plate Actuator Motor.

Output from the vehicle throttle position sensor on the air throttle plate shaft was used to measure throttle position and data was recorded at 100 HZ with GTL' s data acquisition system. Testing was conducted to simulate the normal removal of the driver's foot from the accelerator pedal. This was performed by depressing the accelerator with a gloved hand which incorporated an electrical contact strip in the depressing forefinger. The accelerator was depressed to the required amount and then the forefinger was quickly removed from the pedal, releasing the accelerator and activating the contact strip for time zero. Failures (excluding spring disconnect) were induced simultaneously with release of the accelerator pedal. Testing was performed with the vehicle in park and the engine running. Return to idle times were determined for four throttle plate positions (25%, 50%, 75% and 100%) with the accelerator control system complete and with each of the two APS return springs in the accelerator pedal assembly independently disconnected. Disconnection of the throttle body return spring was not possible due to the unit being sealed and not serviceable. With each of the wires to the

APS and throttle plate position sensor disconnected and shorted to ground, return to idle times were determined at the worst case condition – wide open throttle (100%).

SECTION 2 (Continued)

In addition, tests were conducted with the APS and TPS connectors disconnected.

A number of induced failures resulted in the throttle plate return to or below the idle state then shifting to a Limp-Home mode position which allows the vehicle to be removed from the roadway.

This testing was performed at mid ambient temperature of 10º C to 46º C, in accordance with the NHTSA Test Procedure TP-124-06.

SECTION 3
COMPLIANCE TEST DATA

Test data for this test can be found on the following pages. Photographs are found in Section 5 and Test Plots are found in Section 6.

DATA SHEET 1
VEHICLE DESCRIPTION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 TOYOTA TACOMA TRUCK
VEHICLE NHTSA NO.: C75116
VEHICLE VIN: 5TETU62NX7Z468387
DATE OF TEST: OCTOBER 29-30, 2007
TEST LAB: GENERAL TESTING LABORATORIES
VEHICLE ENGINE TYPE: GAS GVWR: 2381 KG
VEHICLE ENGINE SIZE: 4.0 L V6
VEHICLE ACCEL. CONTROL SYSTEM (ACS) (Air or Fuel Throttled): AIR
MAX. BHP ENGINE SPEED: 236 HP
MFR. IDLE RPM: 700 RPM
FUEL METERING DEVICE (Carburetor, fuel injection, etc): FUEL INJECTION

REMARKS: Engine idle RPM when cold 60ºF ambient, is 1500 to 1600 RPM and requires 7 to 8 pound force on the brake pedal to hold vehicle stationary on a level surface.

At operating temperature, vehicle idles at 700 RPM with 5 to 6 pound force required to hold vehicle stationary on a level surface.

Engine Limp Home Mode is approximately 1000 RPM idle at 23% throttle opening and limited throttle use.

RECORDED BY: G. FARRAND DATE: 10/29/07

APPROVED BY: D. MESSICK

DATA SHEET 2
NORMAL OPERATION TEST
(fully operational system)

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 TOYOTA TACOMA TRUCK
VEHICLE NHTSA NO.: C75116
DATE OF TEST: OCTOBER 30, 2007

Check one:

Mid Temp. Test: X Low Temp. Test: High Temp. Test:

SYSTEM CONDITION: COMPLETE (no modifications) Normal Operation

GTL #	ACCELERATOR POSITION % WIDE OPEN THROTTLE (WOT)	THROTTLE POSITION SENSOR READING	RPM	TEMPERATURE (ºC)		THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)	RETURN TIME TO IDLE (Msec)	PASS/ FAIL
				ENGINE COOLANT	AMBIENT			
5898	25%	24%	700	82	20	18%	110	P
5899	50%	51%	700	82	20	18%	210	P
5900	75%	87%	700	82	20	18%	250	P
5901	100%	100%	700	82	20	18%	240	P

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18º C or less

PASS X FAIL

REMARKS:

RECORDED BY: G. FARRAND DATE: 10/30/07

APPROVED BY: D. MESSICK

DATA SHEET 3 (1 of 2)
FAIL-SAFE OPERATION
DISCONNECTION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 TOYOTA TACOMA TRUCK
VEHICLE NHTSA NO.: C75116
DATE OF TEST: OCTOBER 30, 2007

Check one:

Mid Temp. Test: X Low Temp. Test: High Temp. Test:

SYSTEM CONDITION: #1 SPRING DISCONNECTED IN APS

GTL #	ACCELERATOR POSITION % WIDE OPEN THROTTLE (WOT)	THROTTLE POSITION SENSOR READING	RPM	TEMPERATURE (ºC)		THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)	RETURN TIME TO IDLE (Msec)	PASS/ FAIL
				ENGINE COOLANT	AMBIENT			
5902	25%	31%	700	82	24	18%	150	P
5903	50%	53%	700	82	24	18%	180	P
5904	75%	95%	700	82	24	18%	250	P
5905	100%	100%	700	82	24	18%	300	P

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18º C or less

PASS X FAIL

REMARKS: APS INNER SPRING REMOVED

RECORDED BY: G. FARRAND DATE: 10/30/07

APPROVED BY: D. MESSICK

DATA SHEET 3 (2 of 2)
FAIL-SAFE OPERATION
DISCONNECTION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 TOYOTA TACOMA TRUCK
VEHICLE NHTSA NO.: C75116
DATE OF TEST: OCTOBER 30, 2007

Check one:

Mid Temp. Test: X Low Temp. Test: High Temp. Test:

SYSTEM CONDITION: #2 SPRING DISCONNECTED IN APS

GTL #	ACCELERATOR POSITION % WIDE OPEN THROTTLE (WOT)	THROTTLE POSITION SENSOR READING	RPM	TEMPERATURE (ºC)		THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)	RETURN TIME TO IDLE (Msec)	PASS/ FAIL
				ENGINE COOLANT	AMBIENT			
5906	25%	31%	700	82	24	18%	130	P
5907	50%	53%	700	82	24	18%	160	P
5908	75%	76%	700	82	24	18%	190	P
5909	100%	100%	700	82	24	18%	180	P

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18º C or less

PASS X FAIL

REMARKS: APS OUTER SPRING

RECORDED BY: G. FARRAND DATE: 10/30/07

APPROVED BY: D. MESSICK

DATA SHEET 4
FMVSS 124

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 TOYOTA TACOMA TRUCK
VEHICLE NHTSA NO.: C75116
DATE OF TEST: OCTOBER 30, 2007

GTL #	CONNECTOR	WIRE/PIN DESCRIPTION	FAULT CONDITION	ENGINE TEMP. ºC	% THROTTLE/ RETURN TIME (MS)	PASS/FAIL/NOTES
5910	APS	#1/Red/Yellow Stripe	OPEN	82	100/180	P
5911	APS	#2/Green/Black Stripe	OPEN	82	100/210	P/Limp Home
5912	APS	#3/Red	OPEN	82	100/260	P
5913	APS	#4/Grey/Black Stripe	OPEN	82	100/220	P
5914	APS	#5/Red/Black Stripe	OPEN	82	100/240	P/Limp Home
5915	APS	#6/Blue/White Stripe	OPEN	82	100/250	P
5916	APS	#1/Red/Yellow Stripe	SHORT	82	100/230	P
5917	APS	#2/Green/Black Stripe	SHORT	82	100/260	P
5918	APS	#3/Red	SHORT	82	100/240	P
5919	APS	#4/Grey/Black Stripe	SHORT	82	100/250	P
5920	APS	#5/Red/Black Stripe	SHORT	82	100/230	P
5921	APS	#6/Blue/White Stripe	SHORT	82	100/210	P
5922	APS	CONNECTOR	DISCONNECT	82	100/20	P/Engine Stopped
5923	TPS	#7/Blue	OPEN	82	100/250	P/Limp Home
5924	TPS	#8/Pink	OPEN	82	100/230	P/Limp Home
5925	TPS	#9/White/Black	OPEN	82	100/20	P/Limp Home
5926	TPS	#10/Green/White	OPEN	82	100/130	P/Limp Home
5927	TPS	#11/Blue	OPEN	82	100/70	P/Limp Home
5928	TPS	#12/Green/Black	OPEN	82	100/20	P/Limp Home
5929	TPS	#7/Blue	SHORT	82	100/190	P/Limp Home
5930	TPS	#8/Pink	SHORT	82	100/400	P/Engine Stopped
5931	TPS	#9/White/Black	SHORT	82	100/240	P
5932	TPS	#10/Green/White	SHORT	82	100/190	P/Limp Home
5933	TPS	#11/Blue	SHORT	82	100/20	P/Engine Stopped
5934	TPS	#12/Green/Black	SHORT	82	100/30	P/Limp Home
5935	TPS	CONNECTOR	OPEN	82	Engine Stopped	P/Engine Stopped*

REMARKS: *Engine stopped immediately and the throttle slowly came to the closed position.

RECORDED BY: G. FARRAND DATE: 10/30/07

APPROVED BY: D. MESSICK

SECTION 4
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO.	CAL. DATE	NEXT CAL. DATE
CONTINUOUS RECORDER	OMEGA	CT485	06/07	06/08
ENGINE RECORDING	GTL COMPUTER	CPU1	BEFORE USE	BEFORE USE
ENGINE RECORDING	MONARCH	1444664	08/07	08/08
SOFTWARE	GTL	N/A	BEFORE USE	BEFORE USE
CHAMBER	GTL	N/A	N/A	N/A
EXHAUST DUCT	GTL	N/A	N/A	N/A

SECTION 5
PHOTOGRAPHS

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.1
FRONT VIEW OF VEHICLE

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

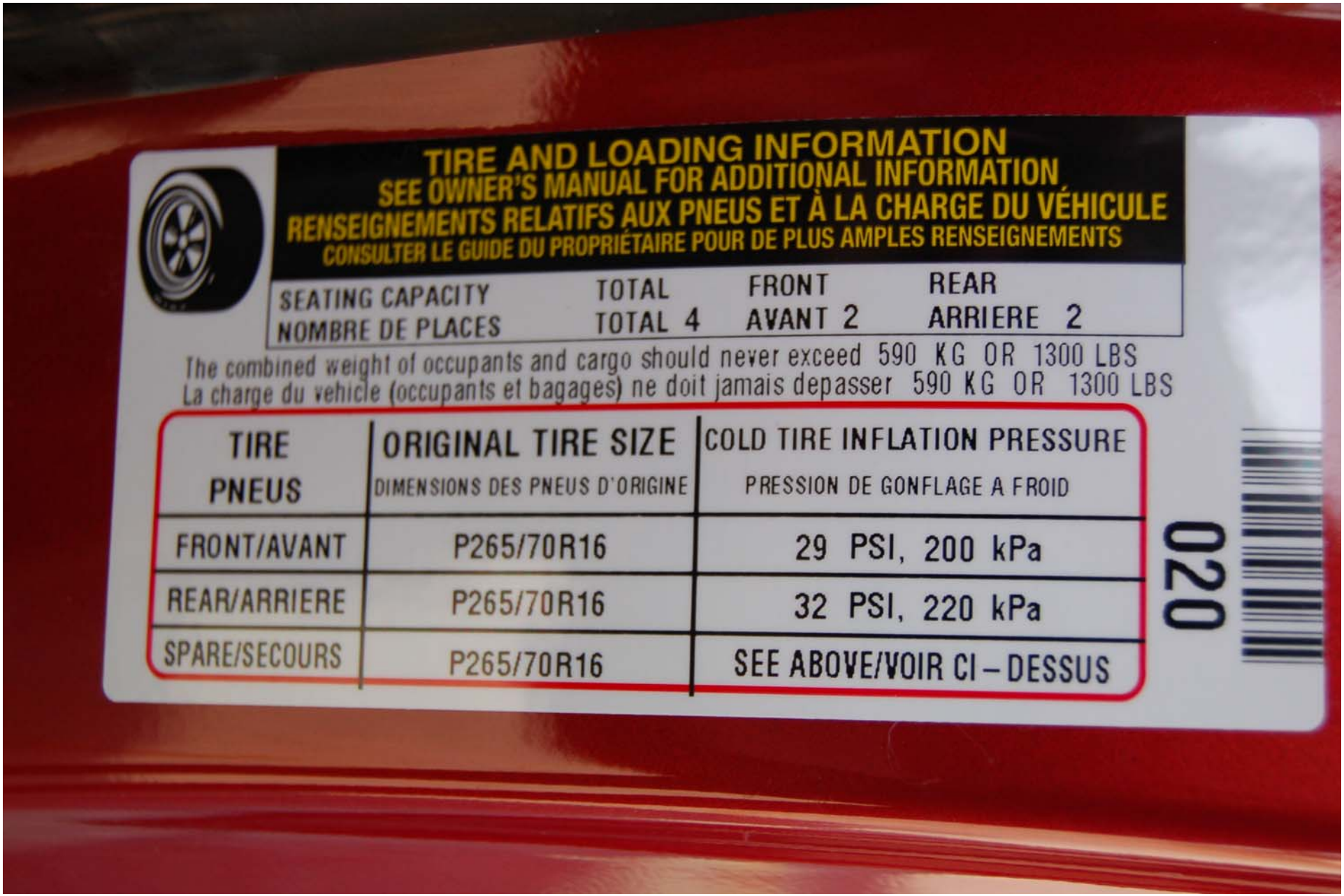
FIGURE 5.2
LEFT SIDE VIEW OF VEHICLE

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.3
RIGHT SIDE VIEW OF VEHICLE

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.4
CLOSE-UP VIEW OF VEHICLE CERTIFICATION LABEL

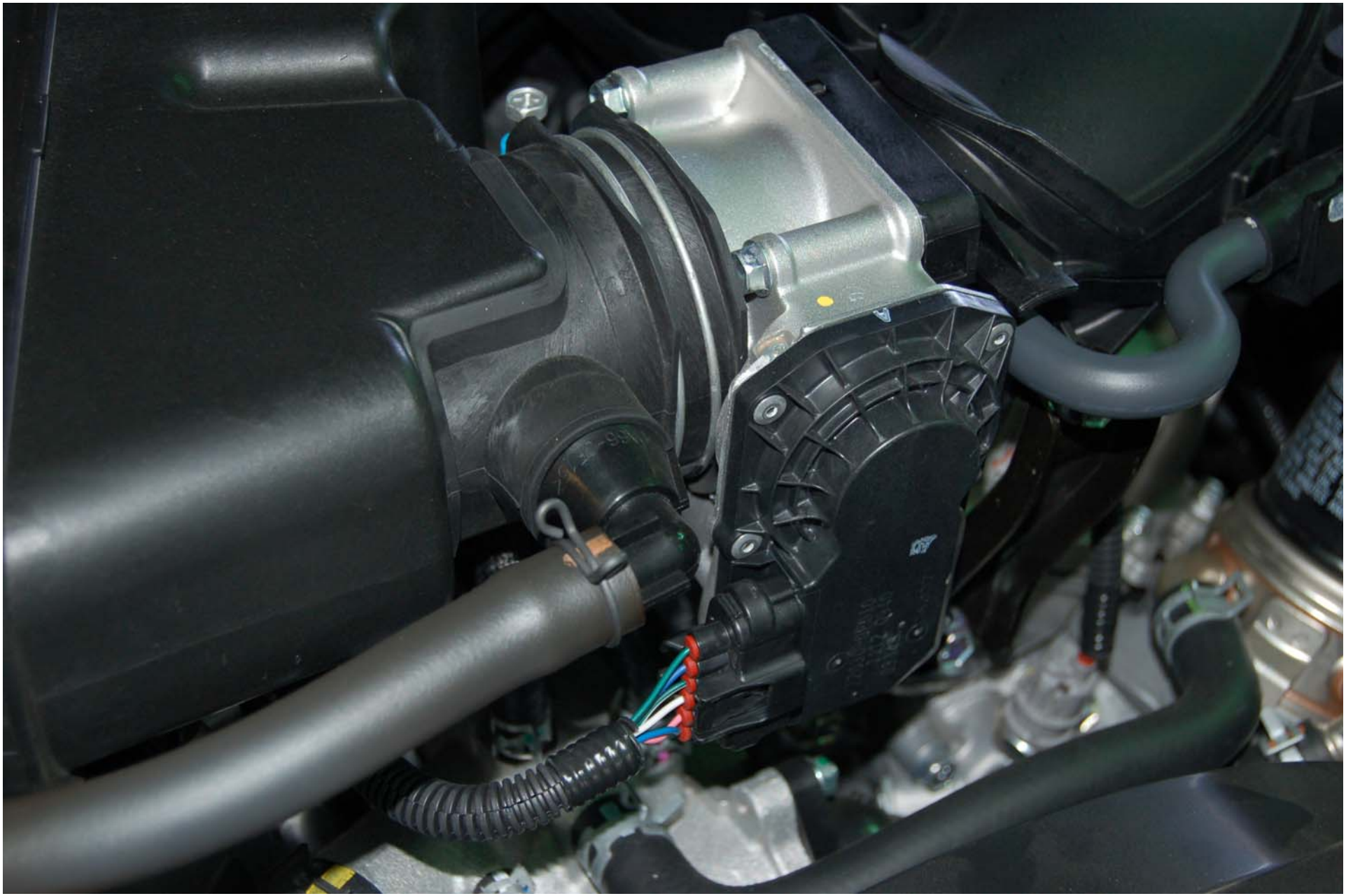


2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.5
CLOSE-UP VIEW OF VEHICLE PLACARD

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.6
THROTTLE BODY AND THROTTLE POSITION SENSOR



2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

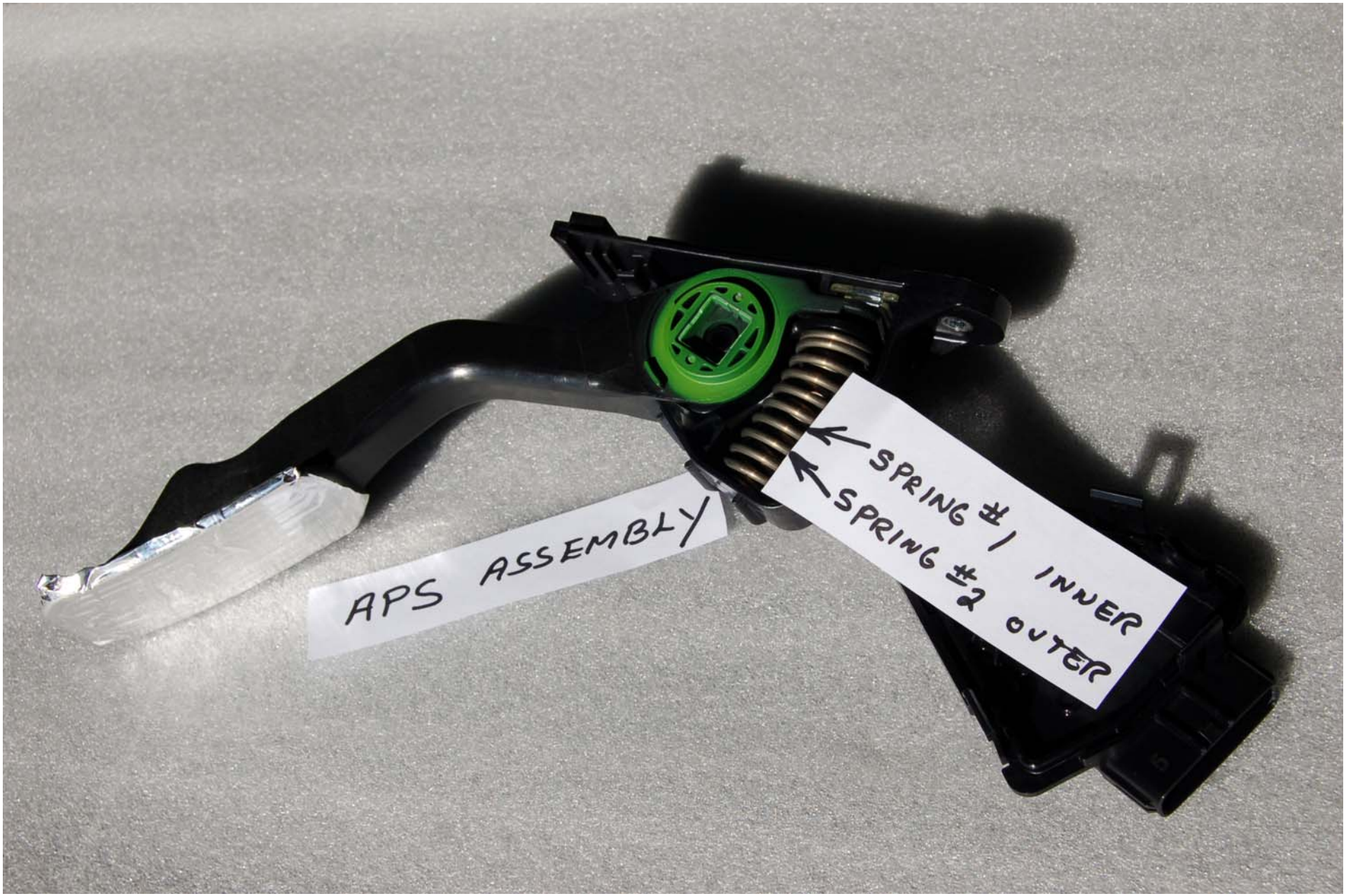
FIGURE 5.7
THROTTLE POSITION SENSOR WIRE CONNECTOR

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.8
ACCELERATOR PEDAL ASSEMBLY

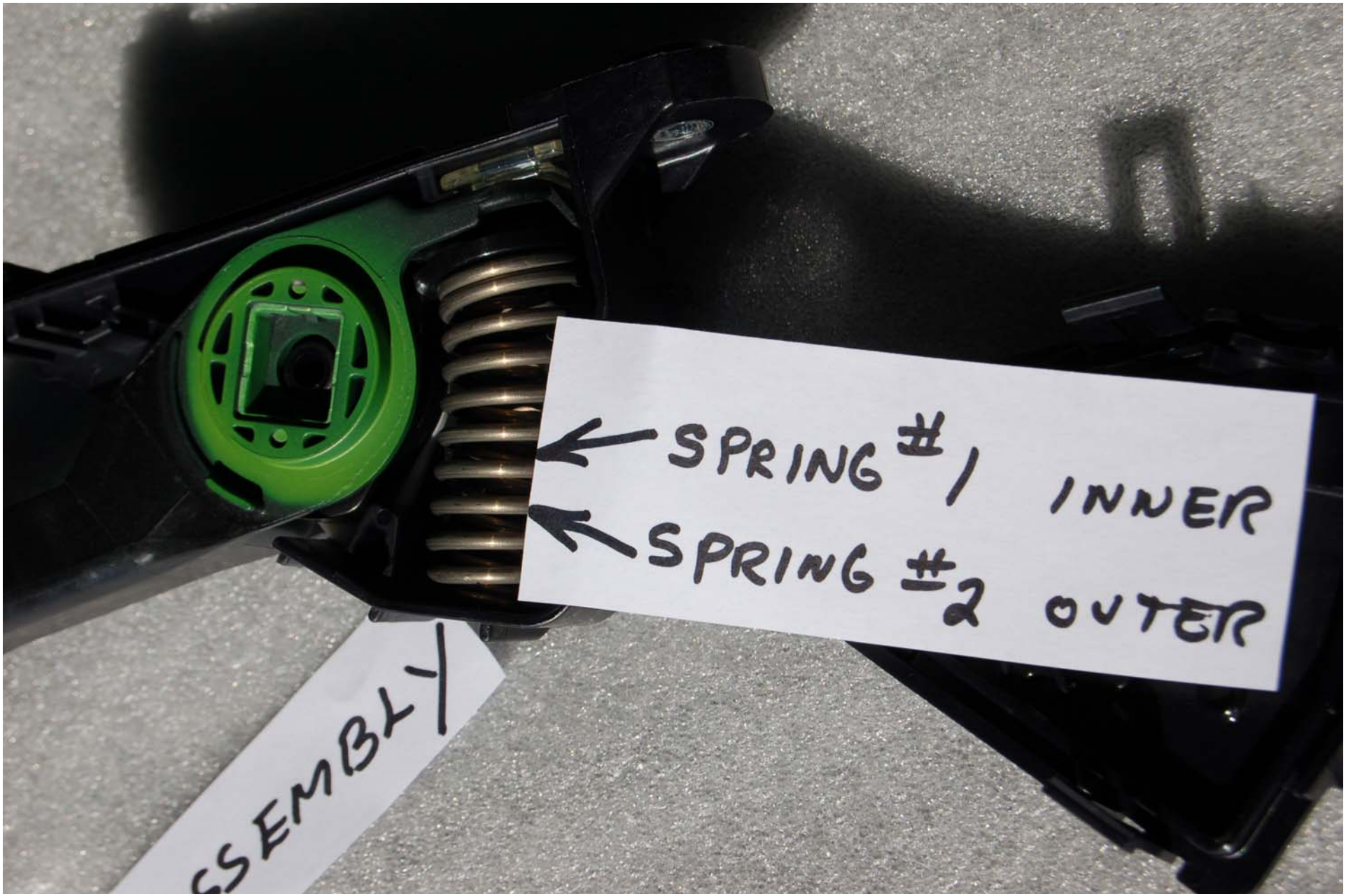
2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.9
ACCELERATOR PEDAL SENSOR



2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.10
ACCELERATOR PEDAL SENSOR WITH SPRINGS #1 & #2



2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.11
ACCELERATOR PEDAL SENSOR CLOSE-UP VIEW

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.12
ACCELERATOR PEDAL SENSOR DISASSEMBLY

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.13
TEST SET-UP WITH DATA RECORDING

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.14
TEST SET-UP TO ACCELERATOR PEDAL SENSOR

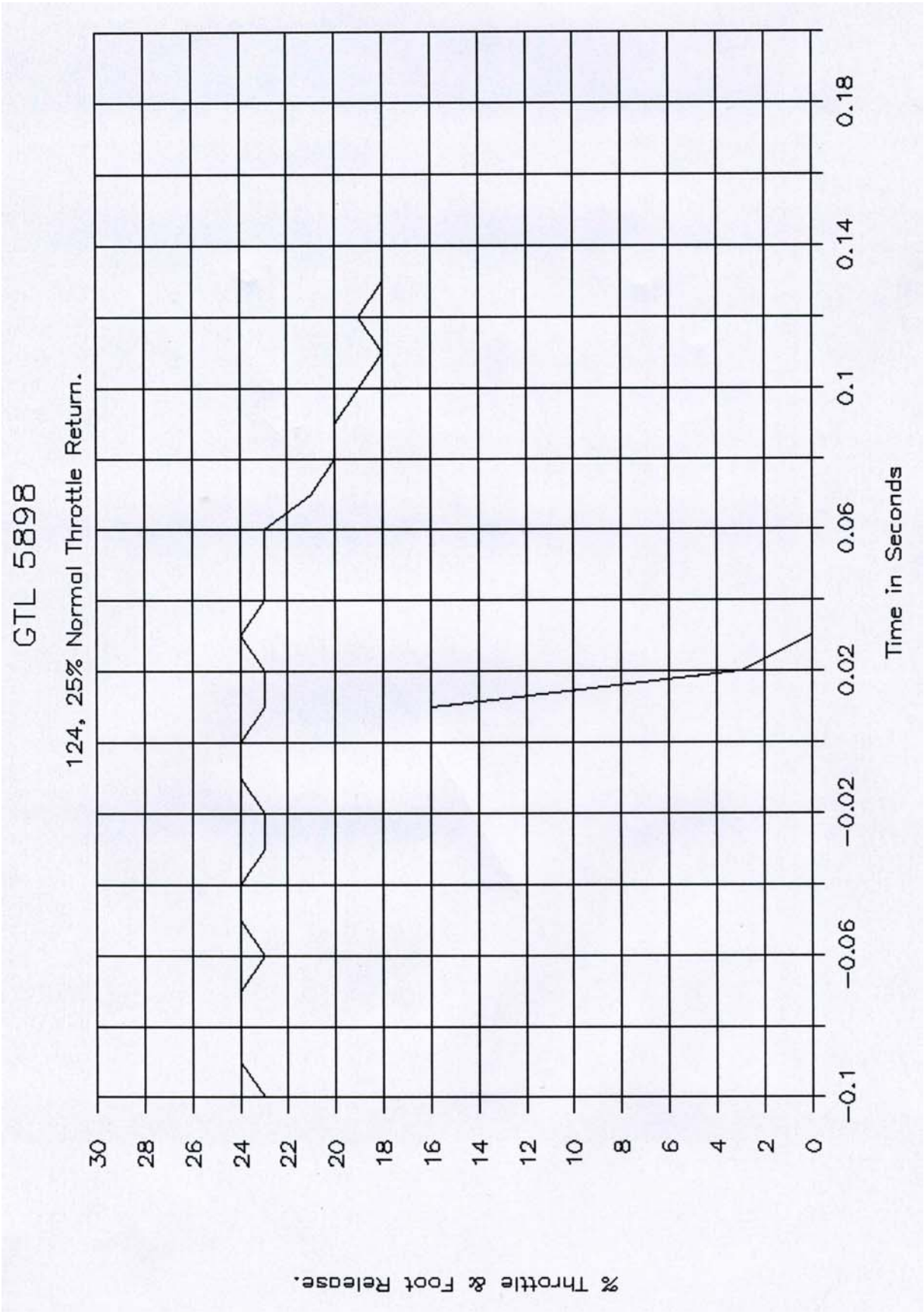
2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.15
TEST SET-UP FOR WIRE CONNECTIONS

2007 TOYOTA TACOMA
NHTSA NO. C75116
FMVSS NO. 124

FIGURE 5.16
TEST SET-UP TO THROTTLE POSITION SENSOR

SECTION 6
PLOTS


GTL 5898
124, 25% Normal Throttle Return.
% Throttle & Foot Release.
Time in Seconds
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
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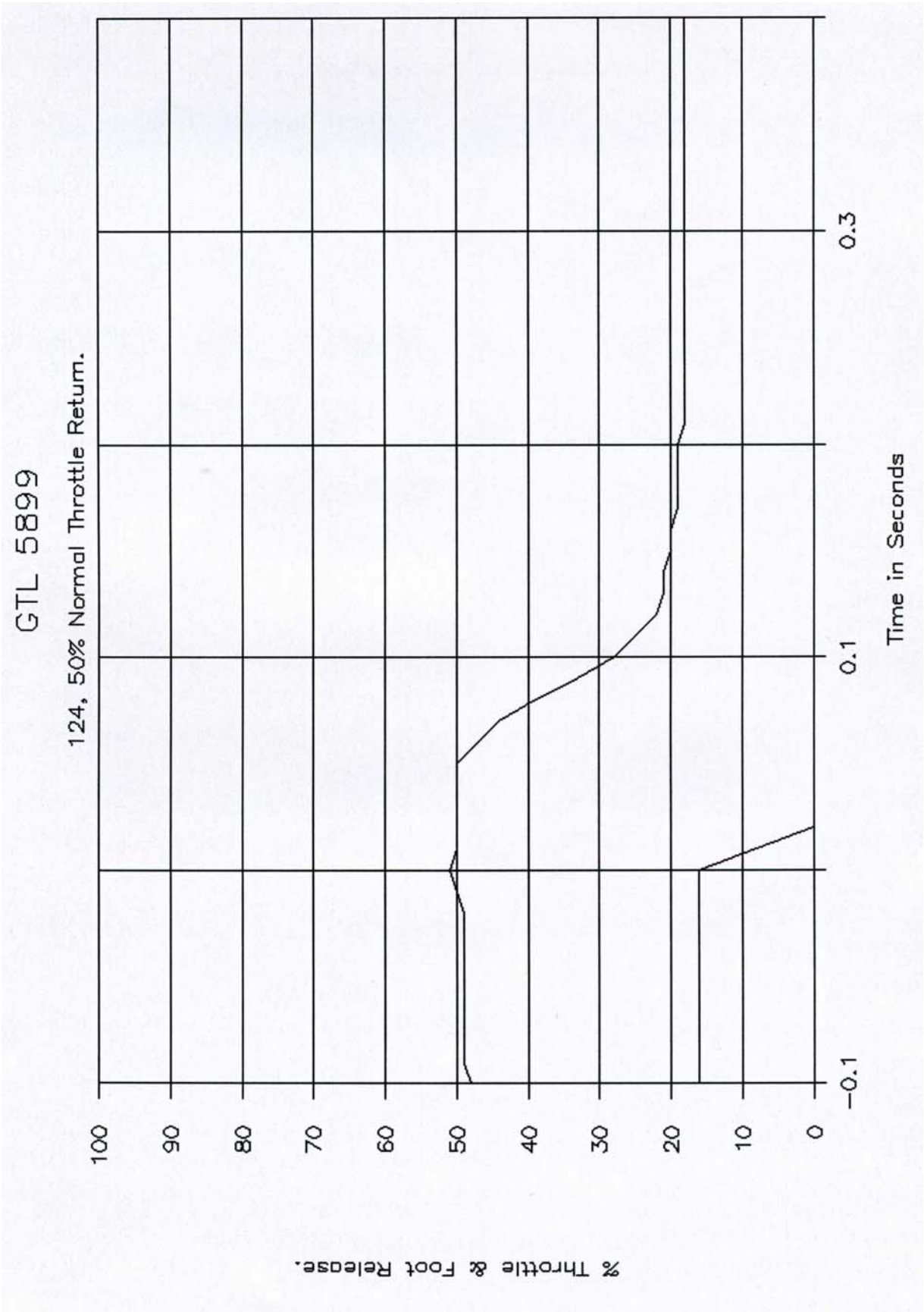
-0.06
-0.02
0.02
0.06
0.1
0.14
0.18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% Throttle & Foot Release.
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60
50
40
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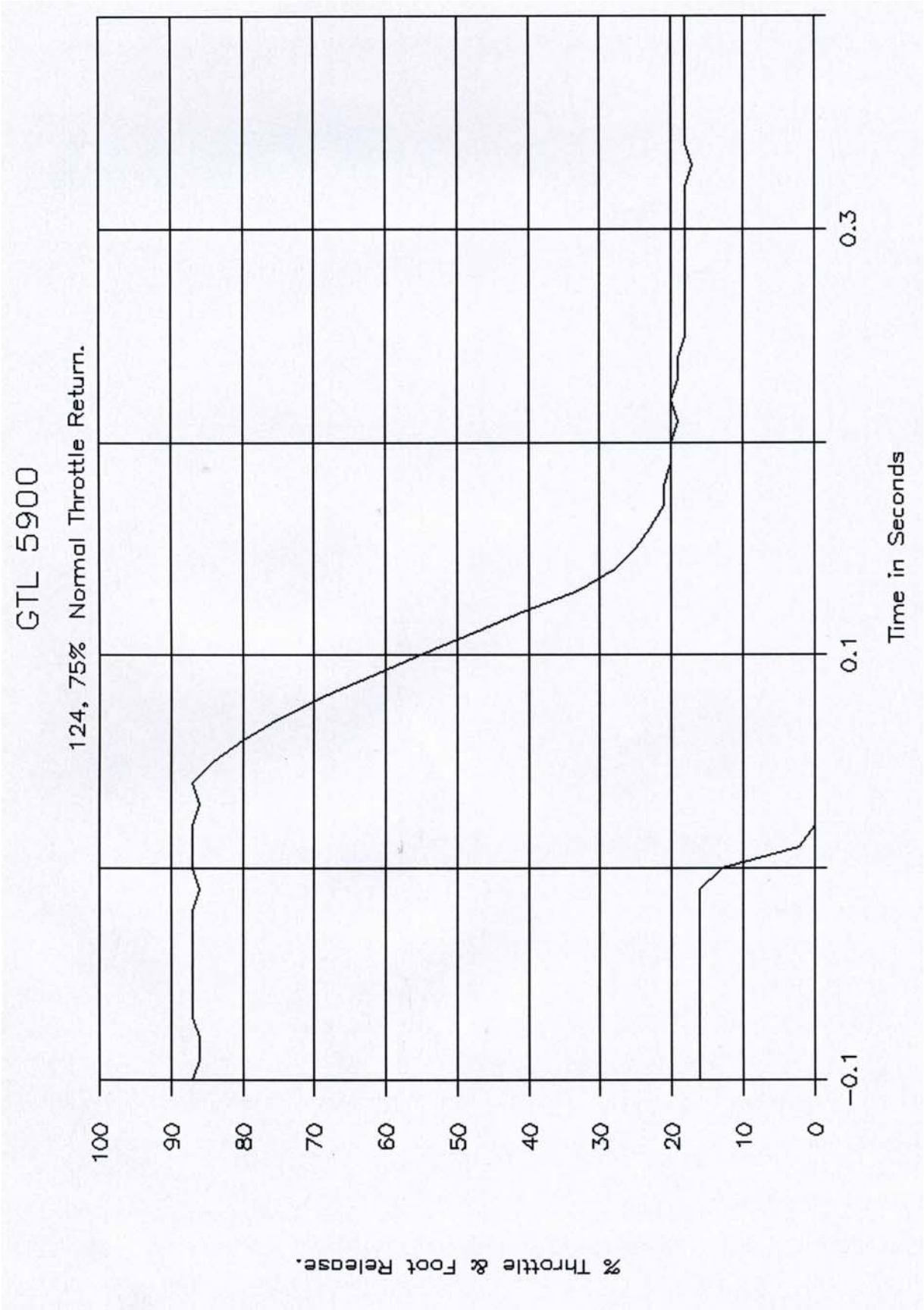
0.3
Time in Seconds


GTL 5900
124, 75% Normal Throttle Return.
% Throttle & Foot Release.
100
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80
70
60
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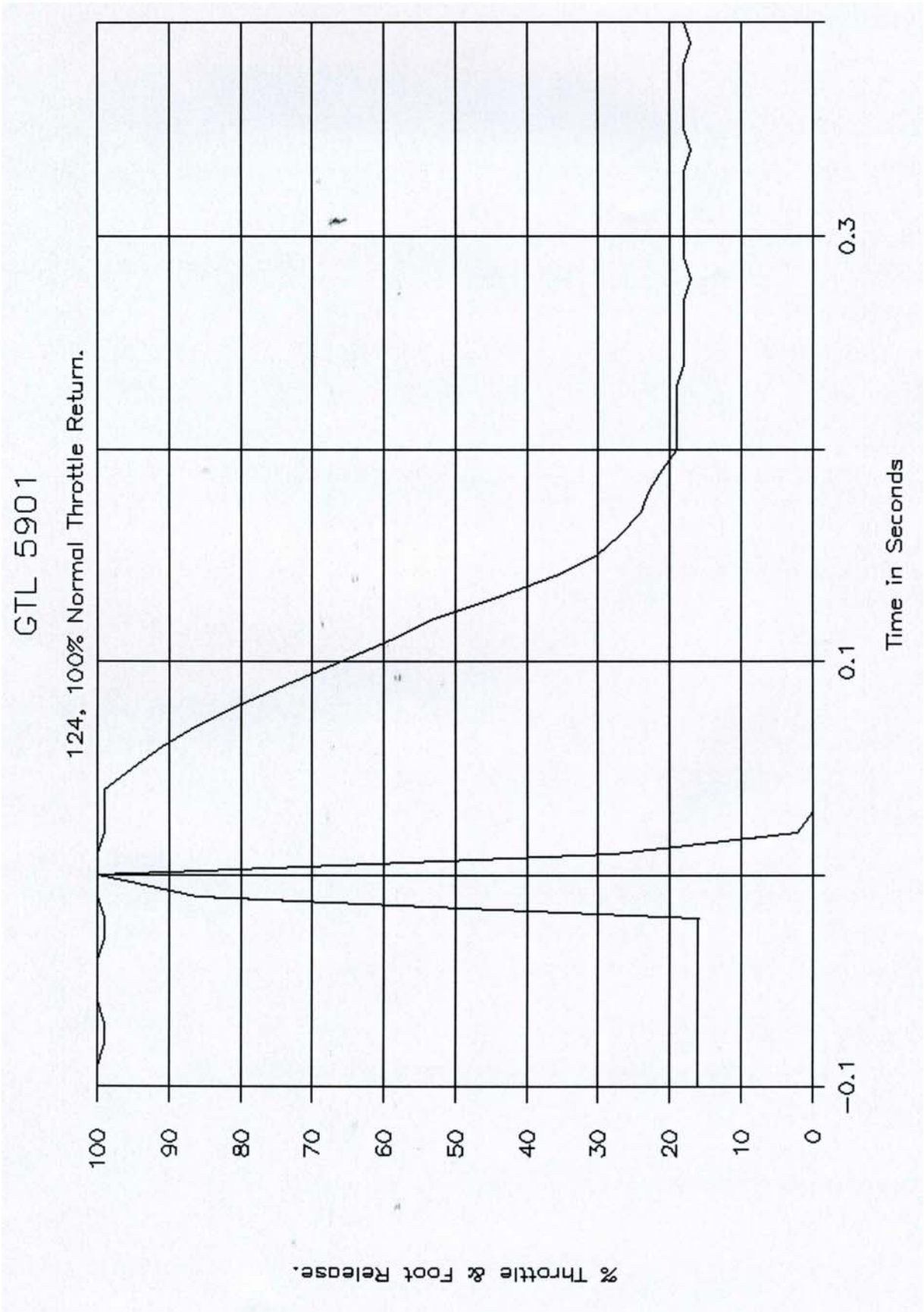
Time in Seconds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% Throttle & Foot Release.
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70
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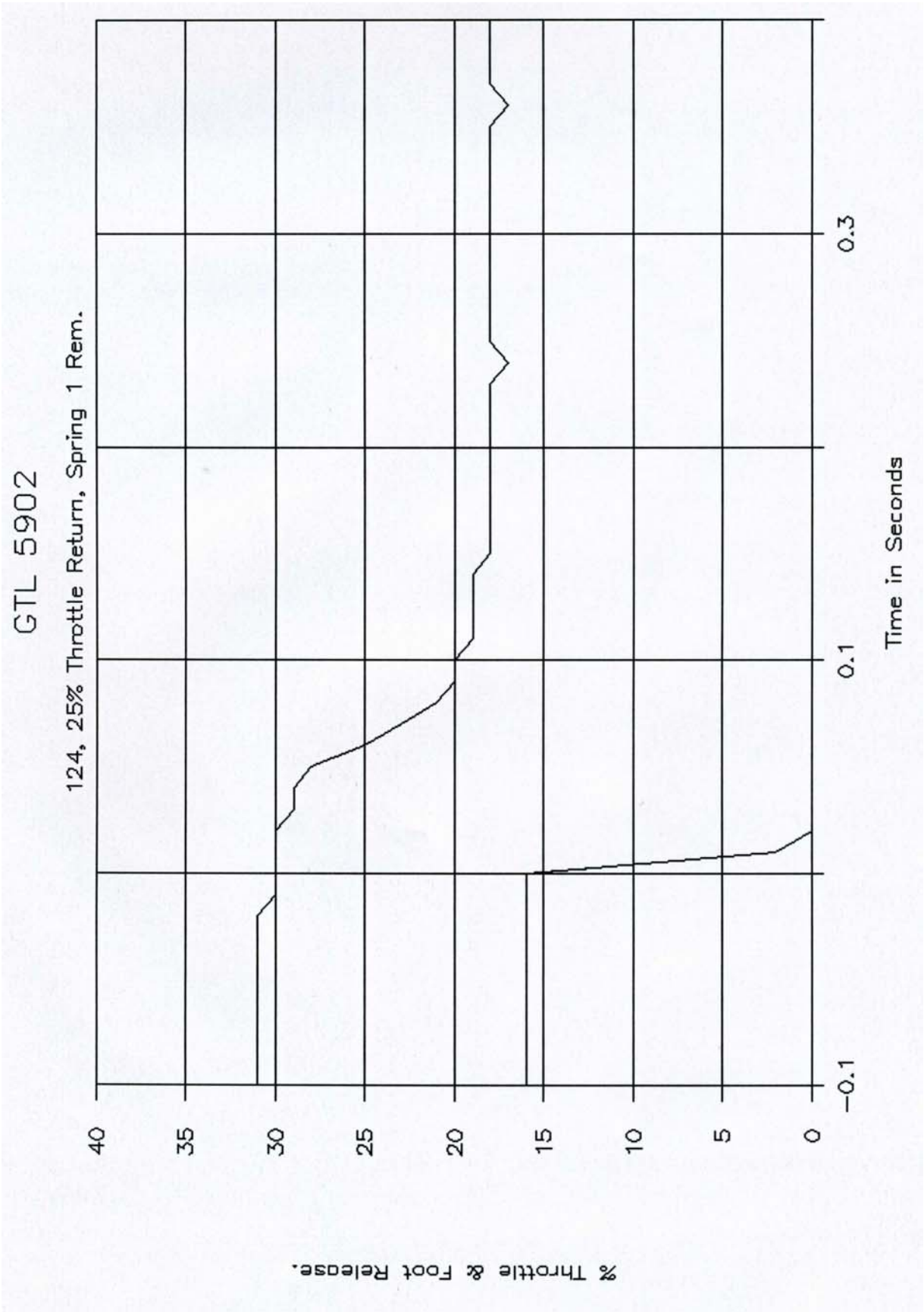
0.3
Time in Seconds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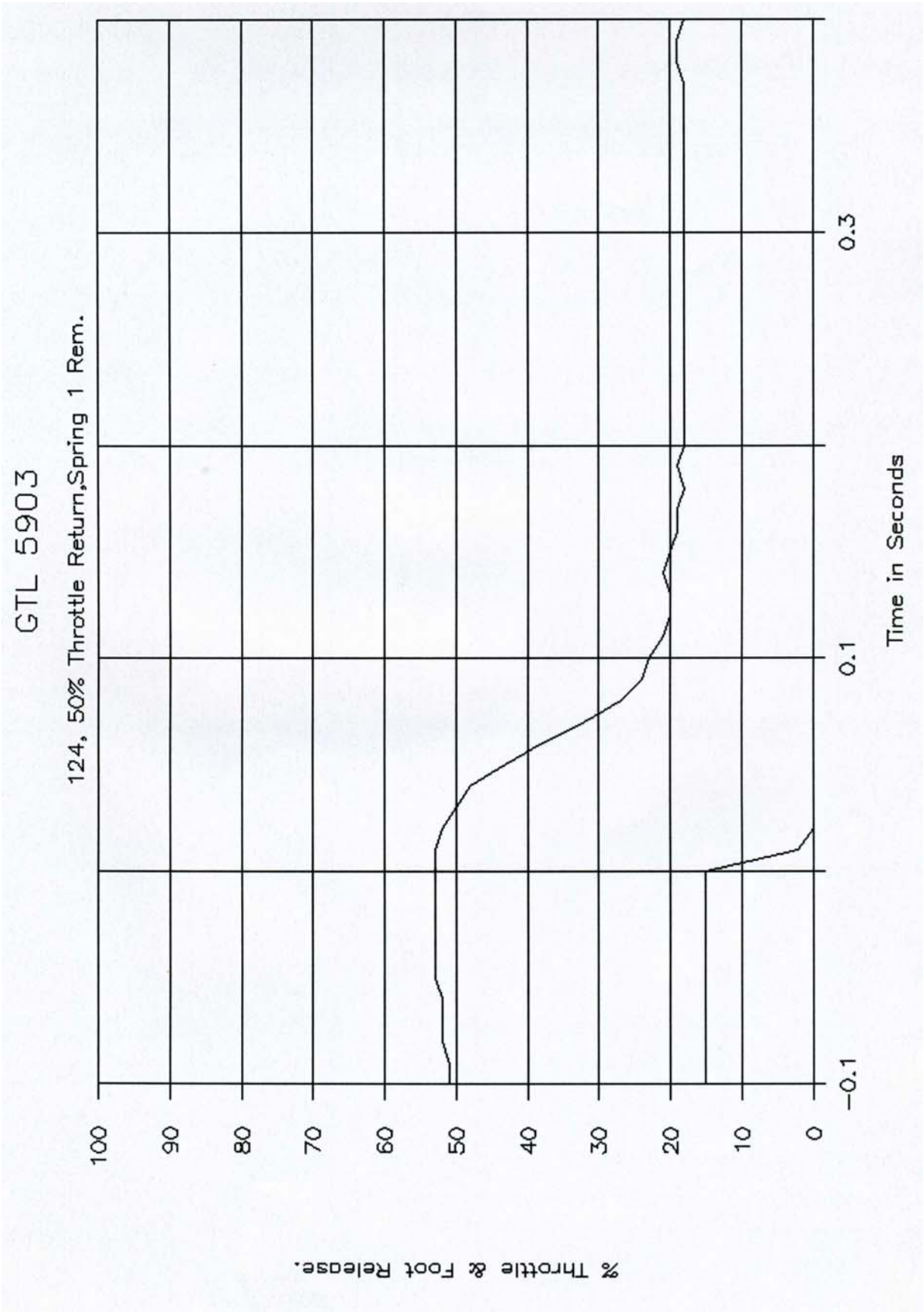
% Throttle & Foot Release.
40
35
30
25
20
15
10
5
0
-0.1
0.1
0.3
Time in Seconds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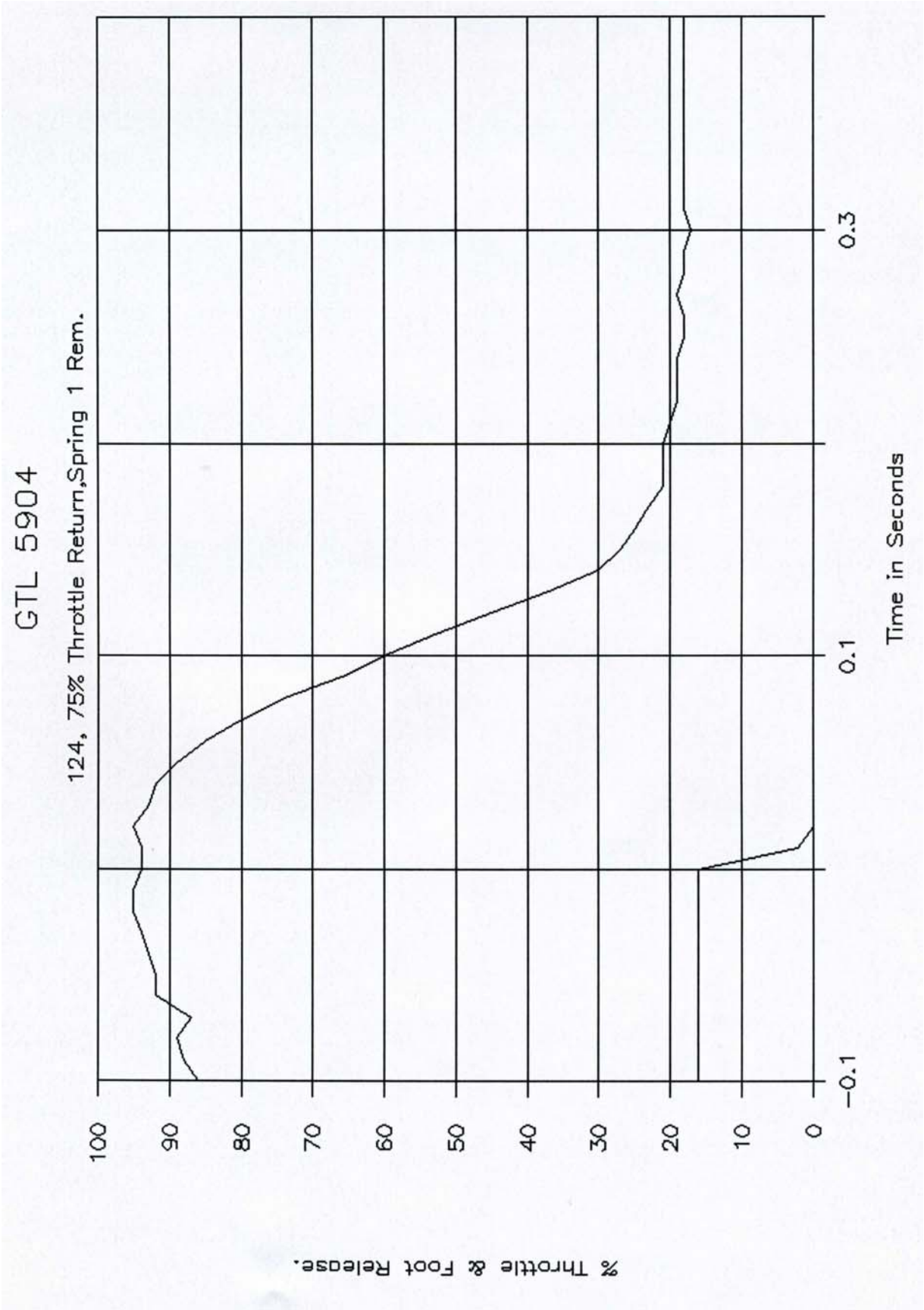
0.1
0.3
Time in Seconds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80
70
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20
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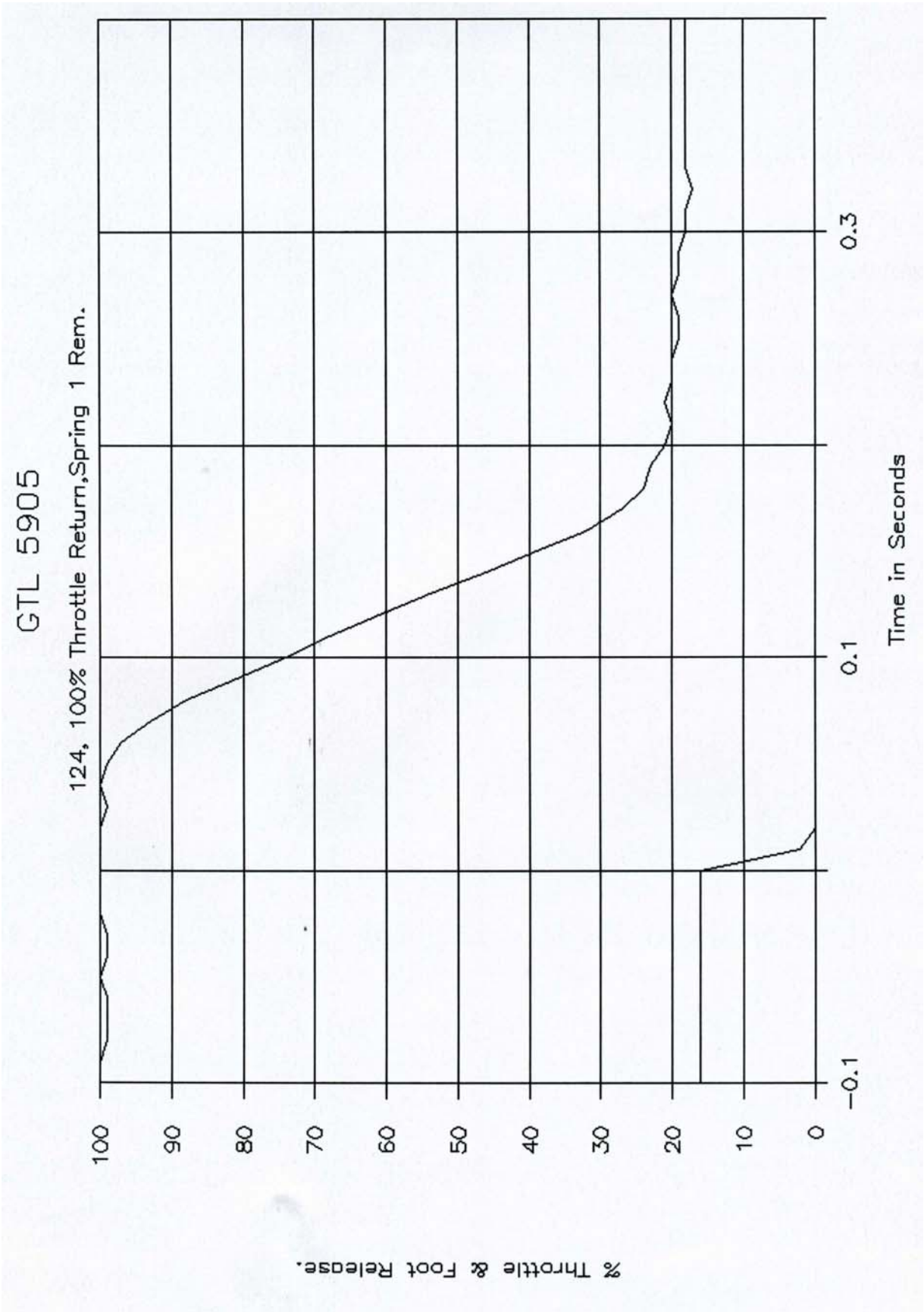
0.1
0.3
Time in Seconds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% Throttle & Foot Release.
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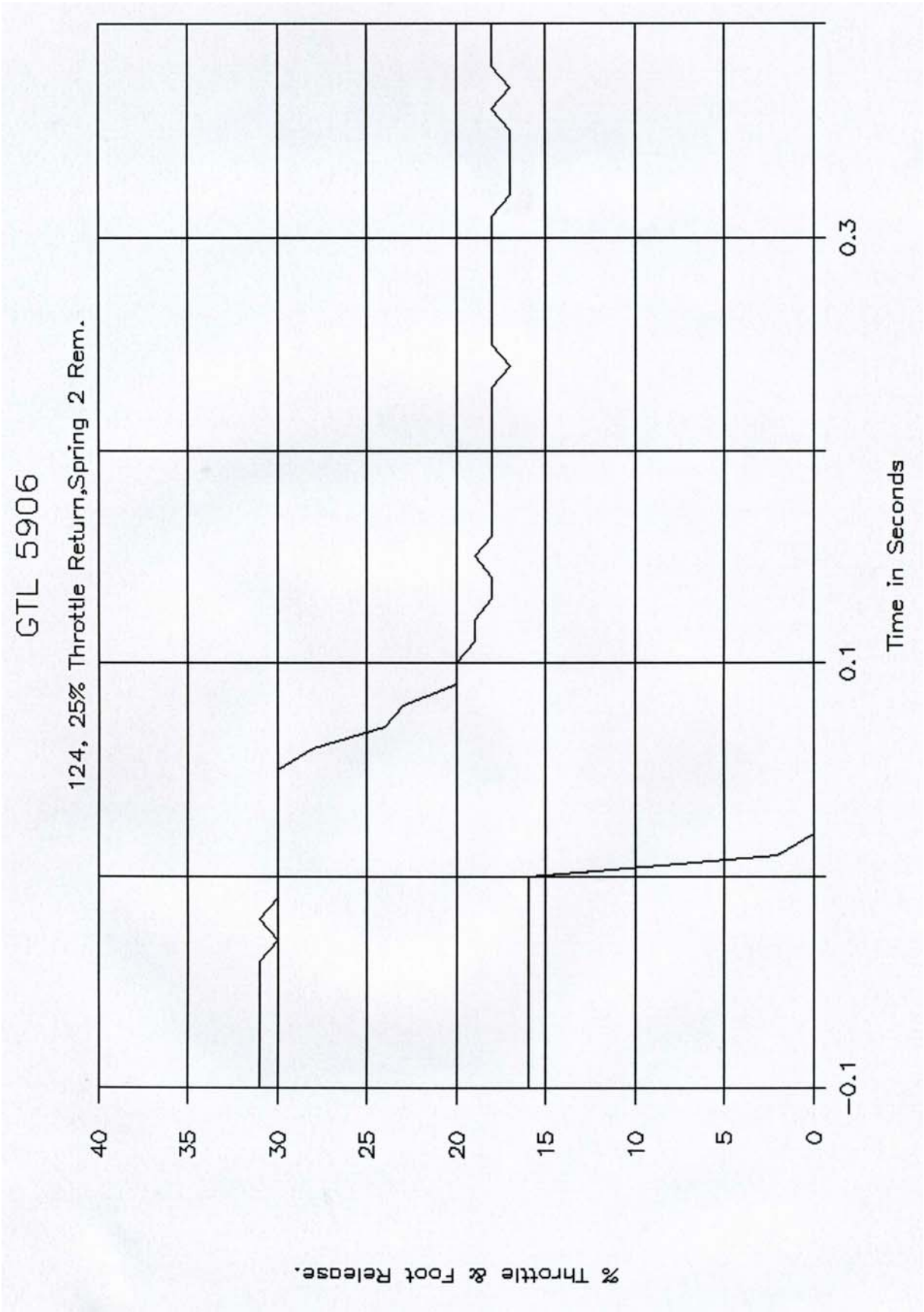
0.1
0.3
Time in Seconds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30
25
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15
10
5
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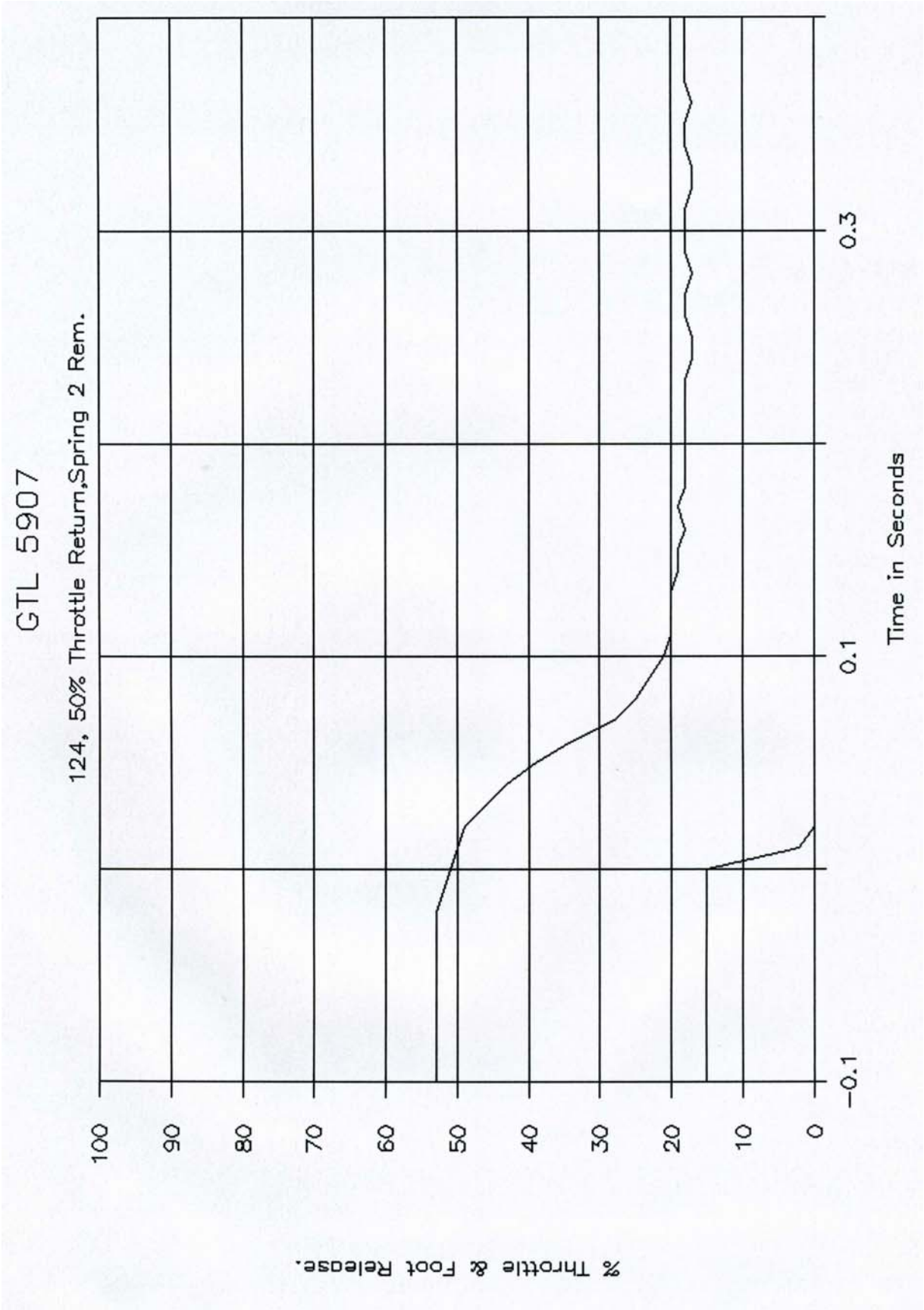
-0.1
0.1
0.3
Time in Seconds


GTL 5907
124, 50% Throttle Return,Spring 2 Rem.
% Throttle & Foot Release.
100
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80
70
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30
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10
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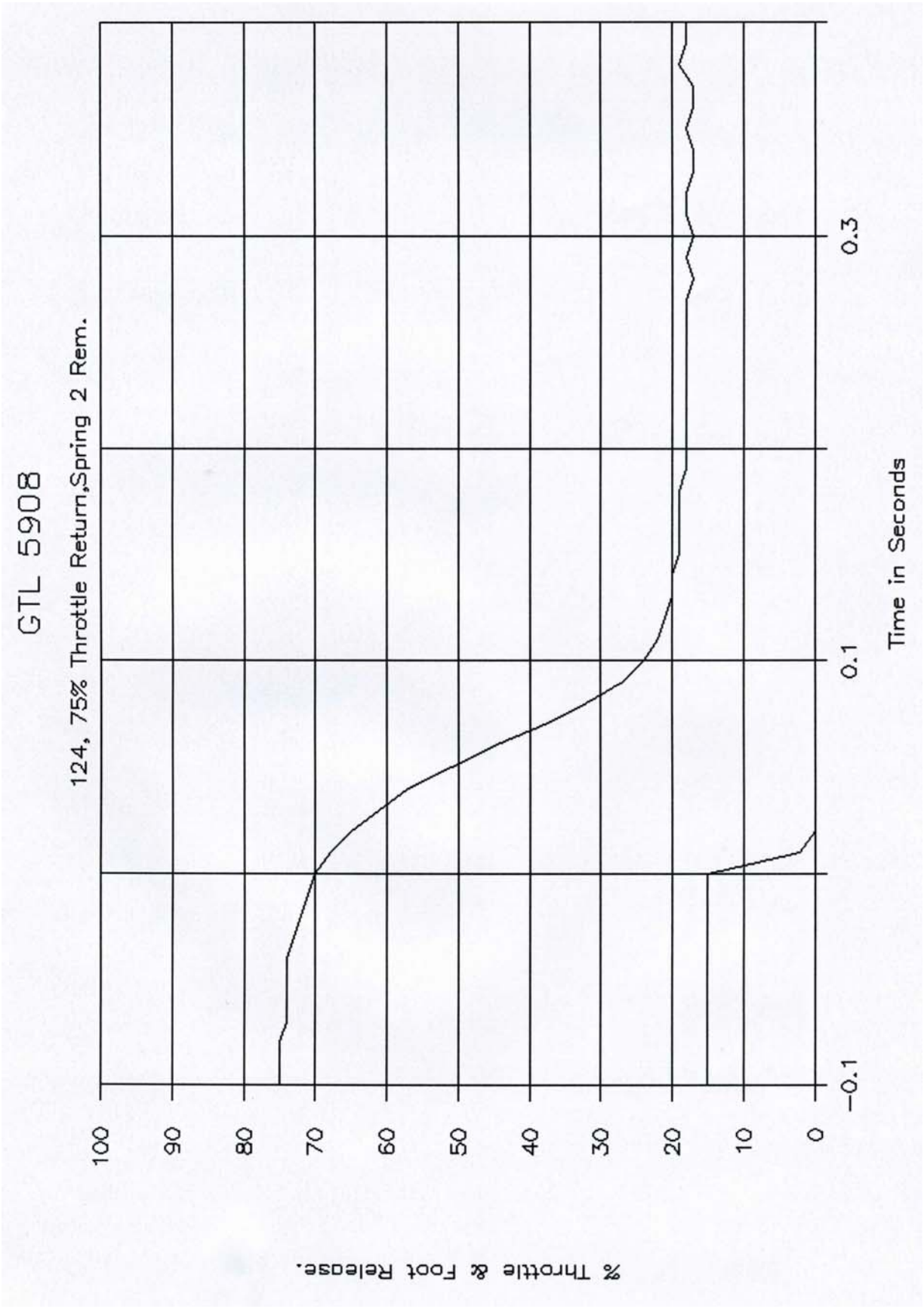
-0.1
0.1
0.3
Time in Seconds


GTL 5908
124, 75% Throttle Return,Spring 2 Rem.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
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10
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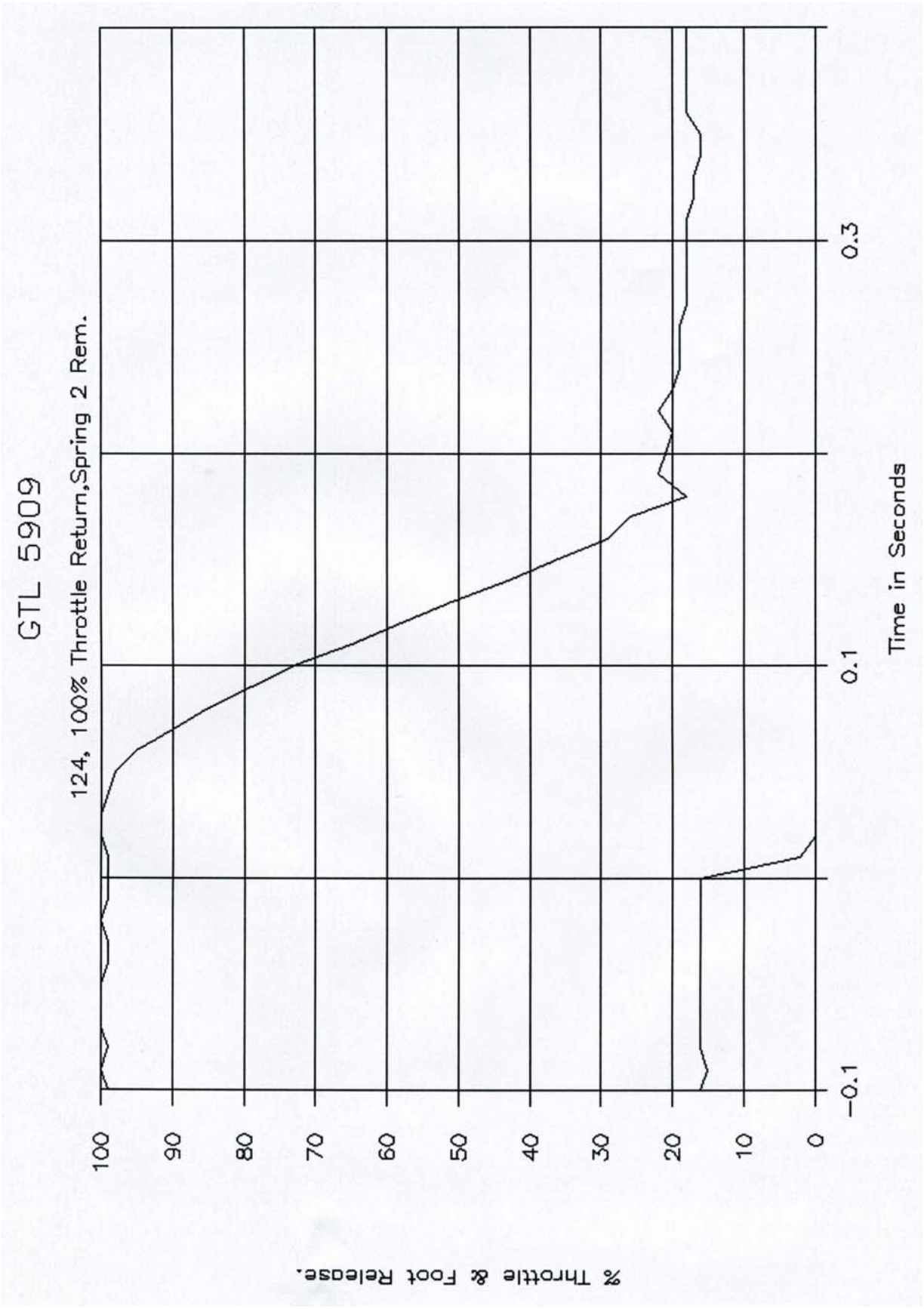
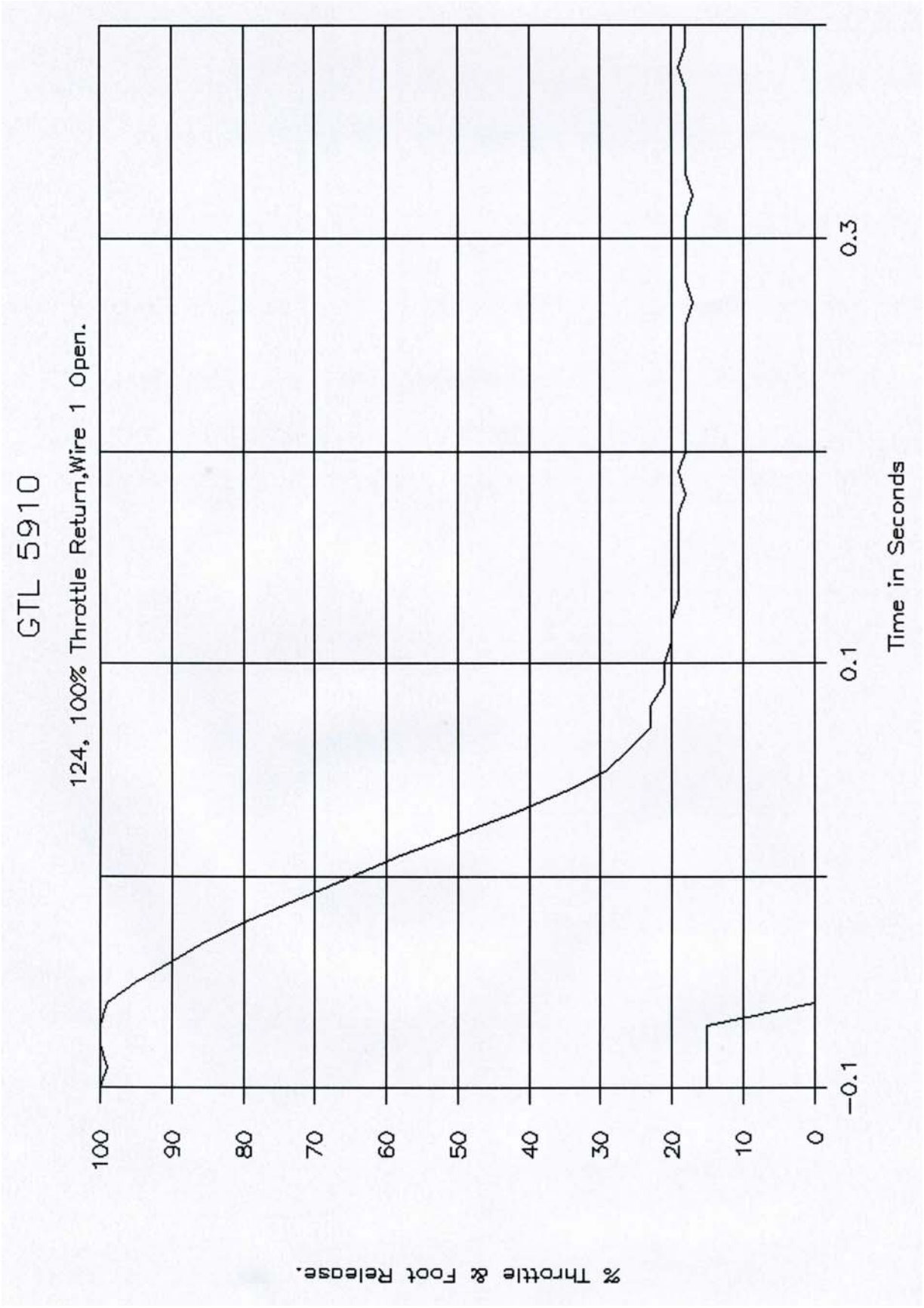
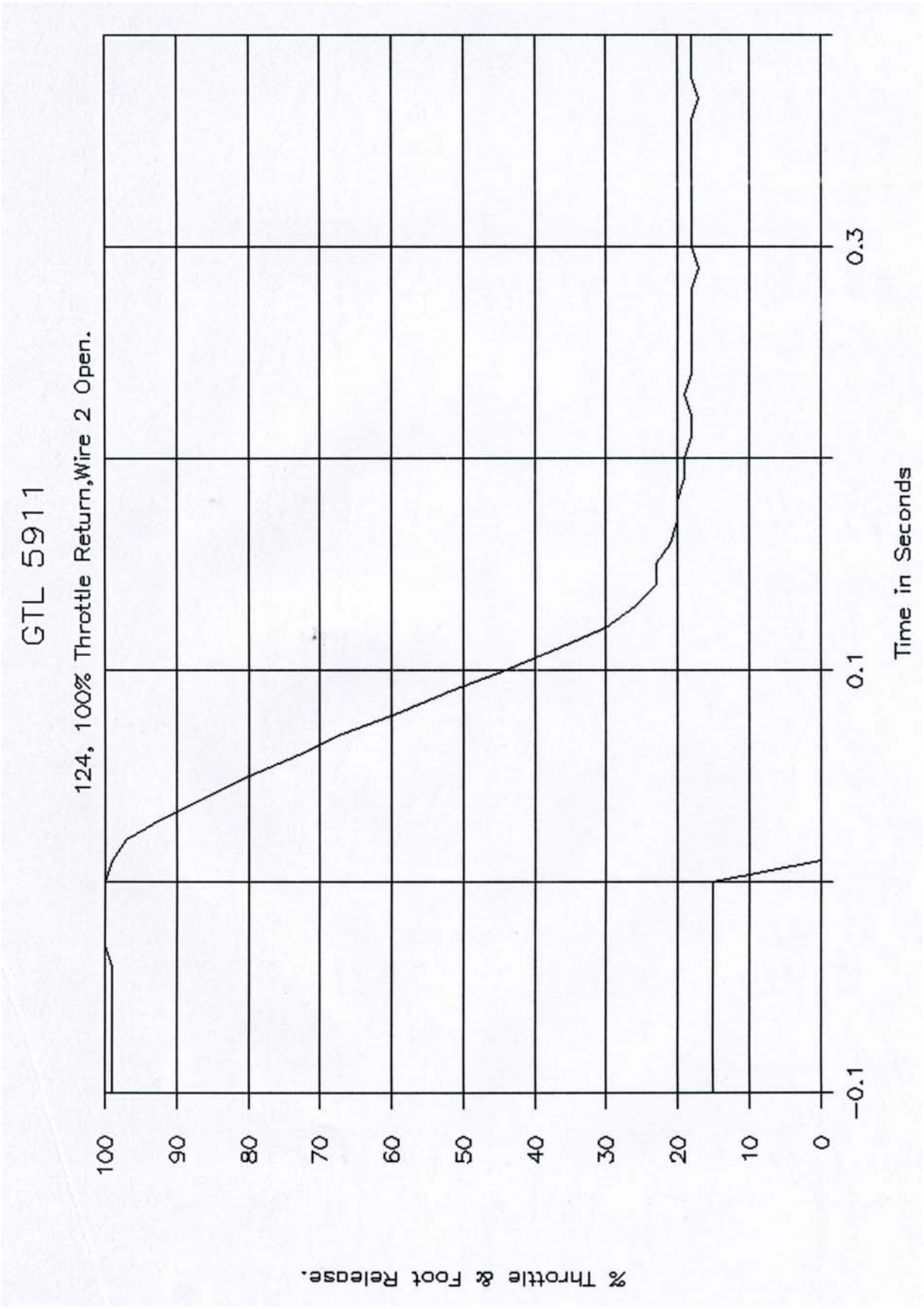
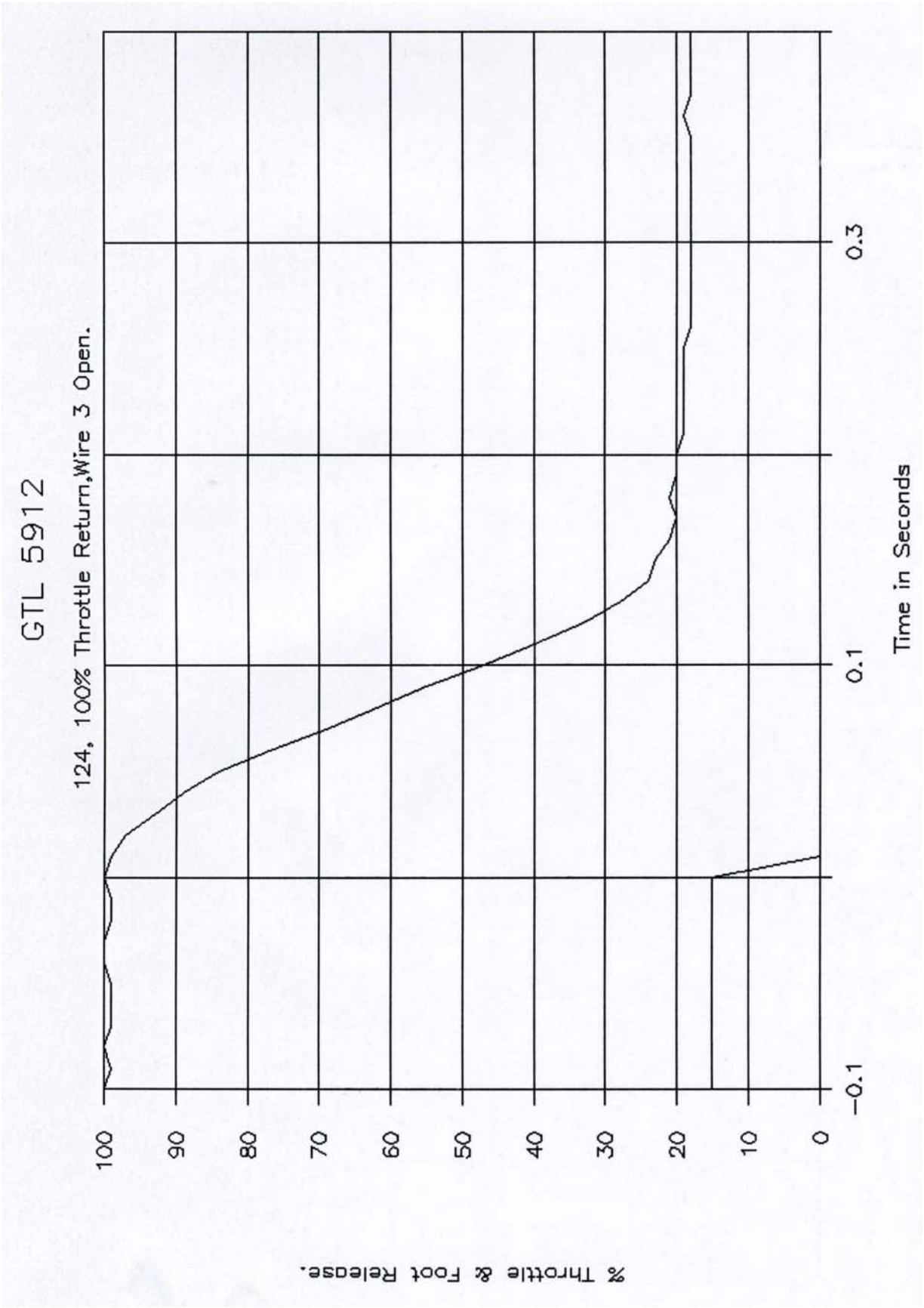
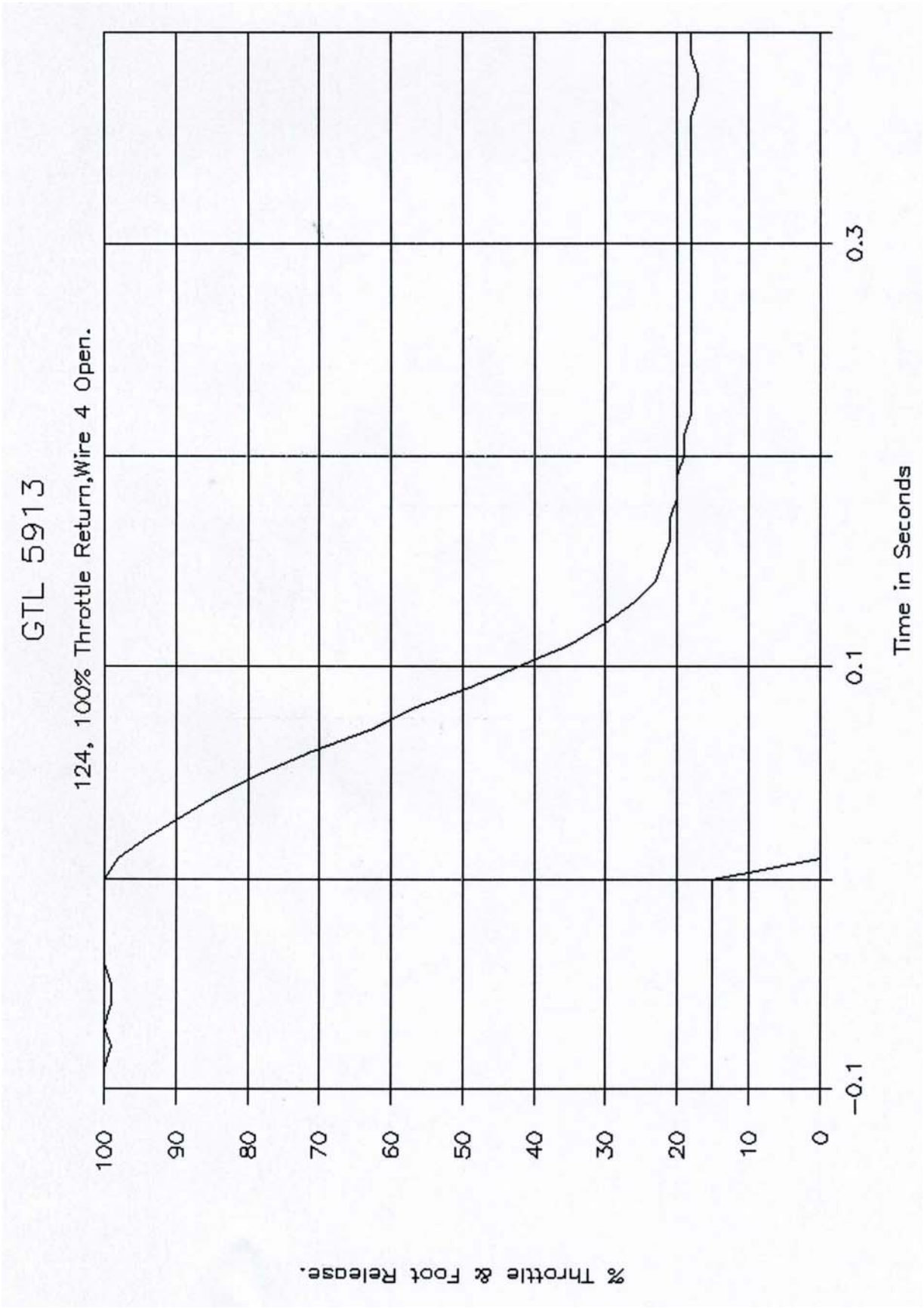
-0.1
0.1
0.3
Time in Seconds

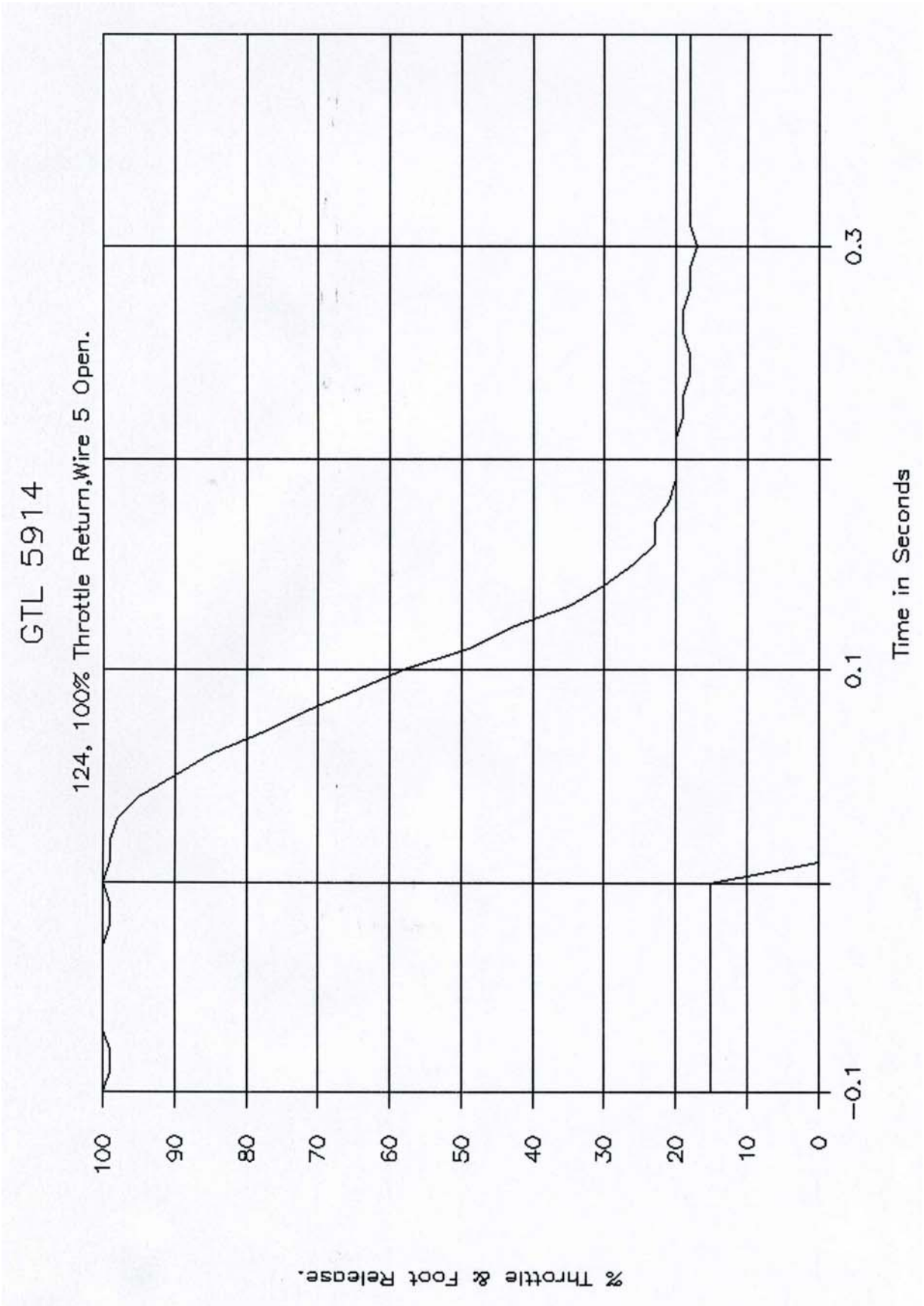

GTL 5909
124, 100% Throttle Return,Spring 2 Rem.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

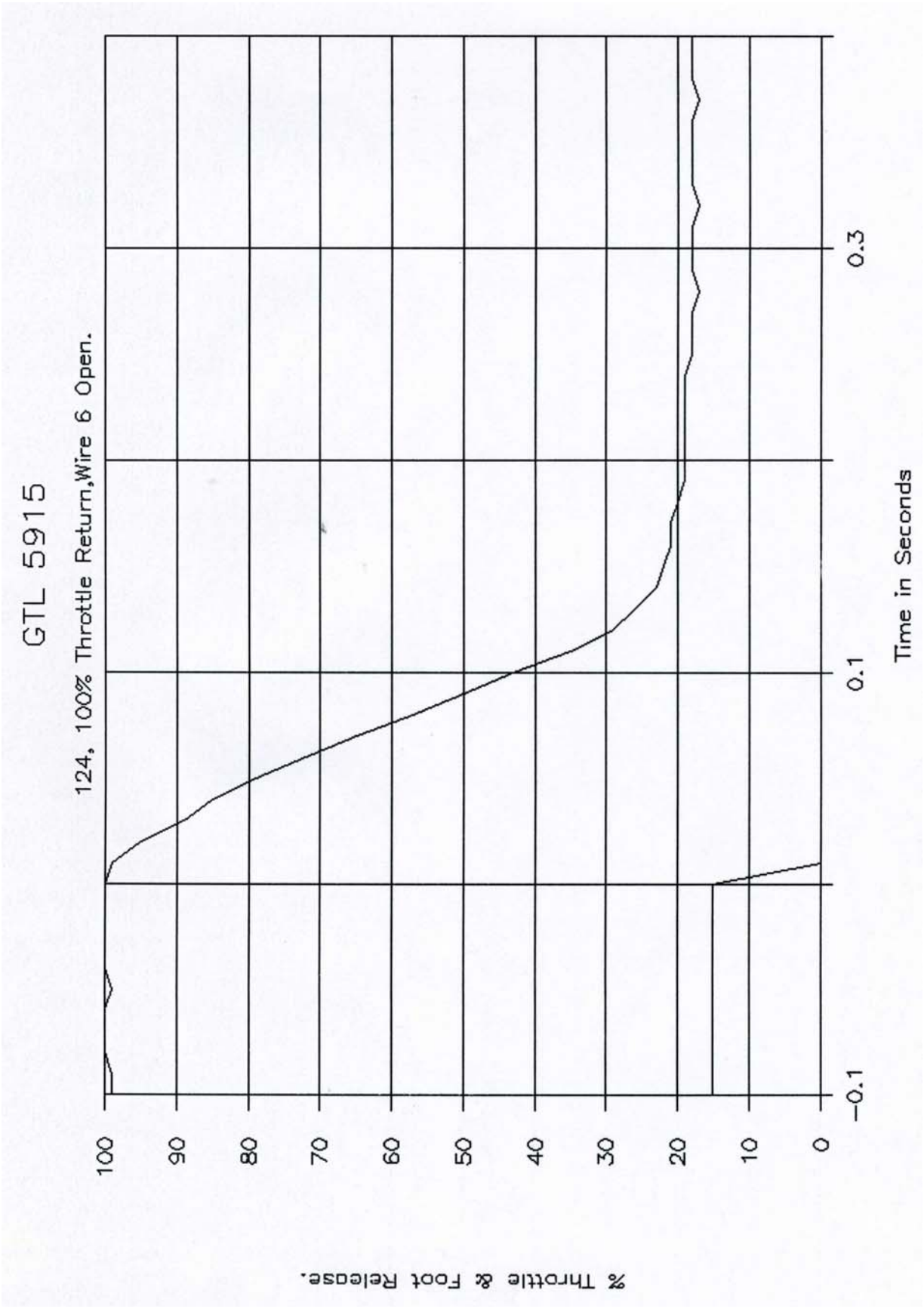

GTL 5910
124, 100% Throttle Return,Wire 1 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

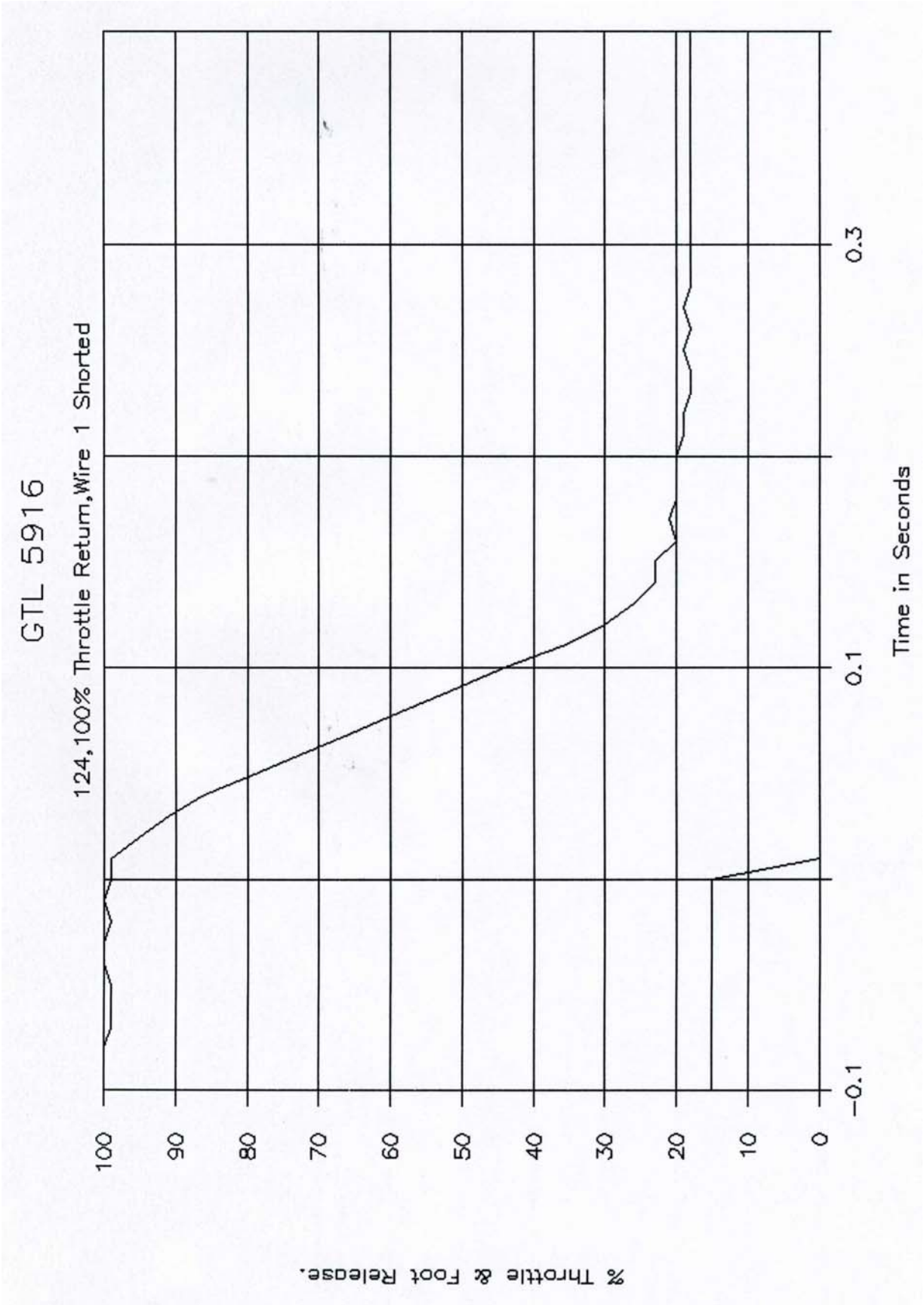

GTL 5911
124, 100% Throttle Return,Wire 2 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

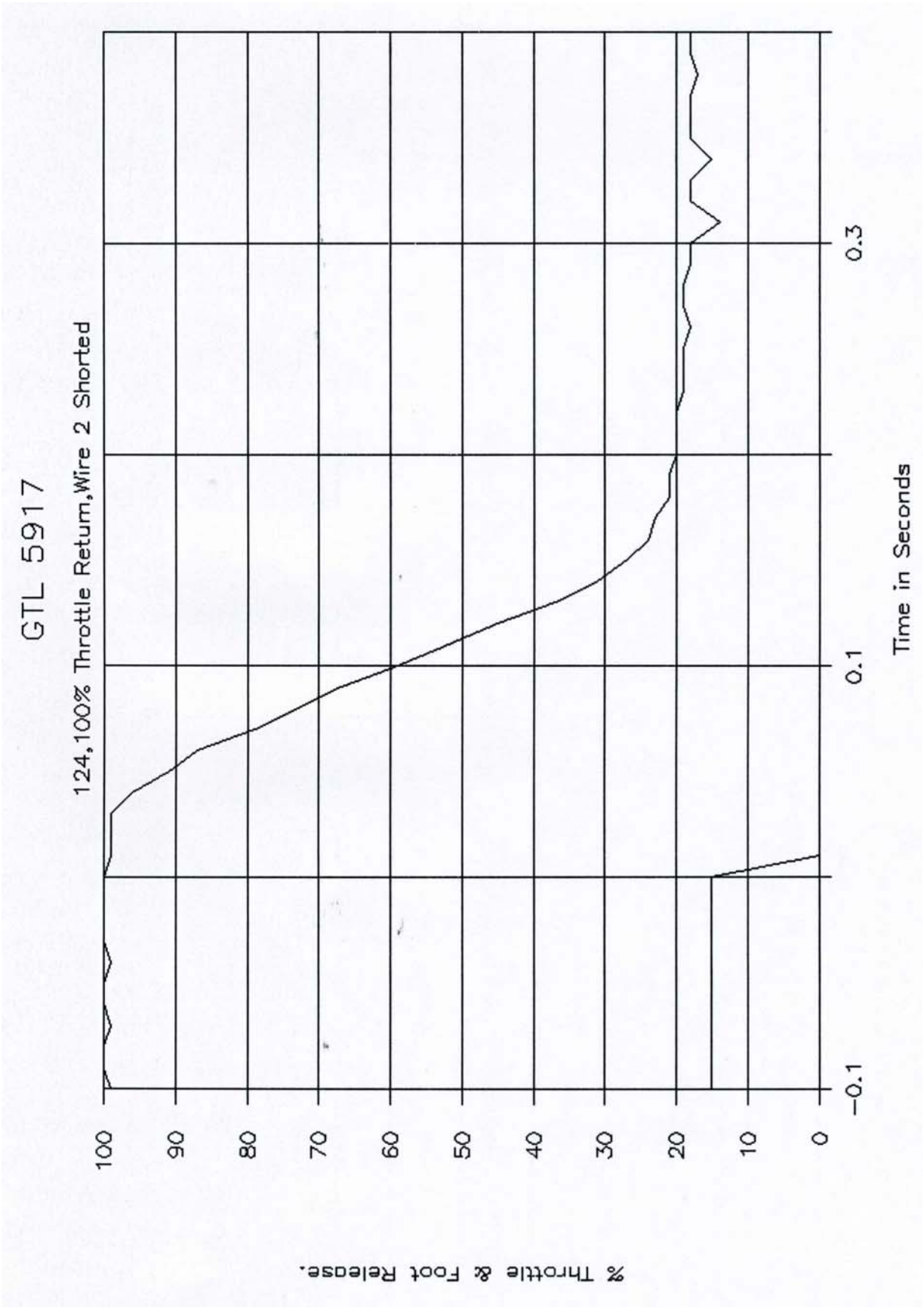

GTL 5912
124, 100% Throttle Return,Wire 3 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

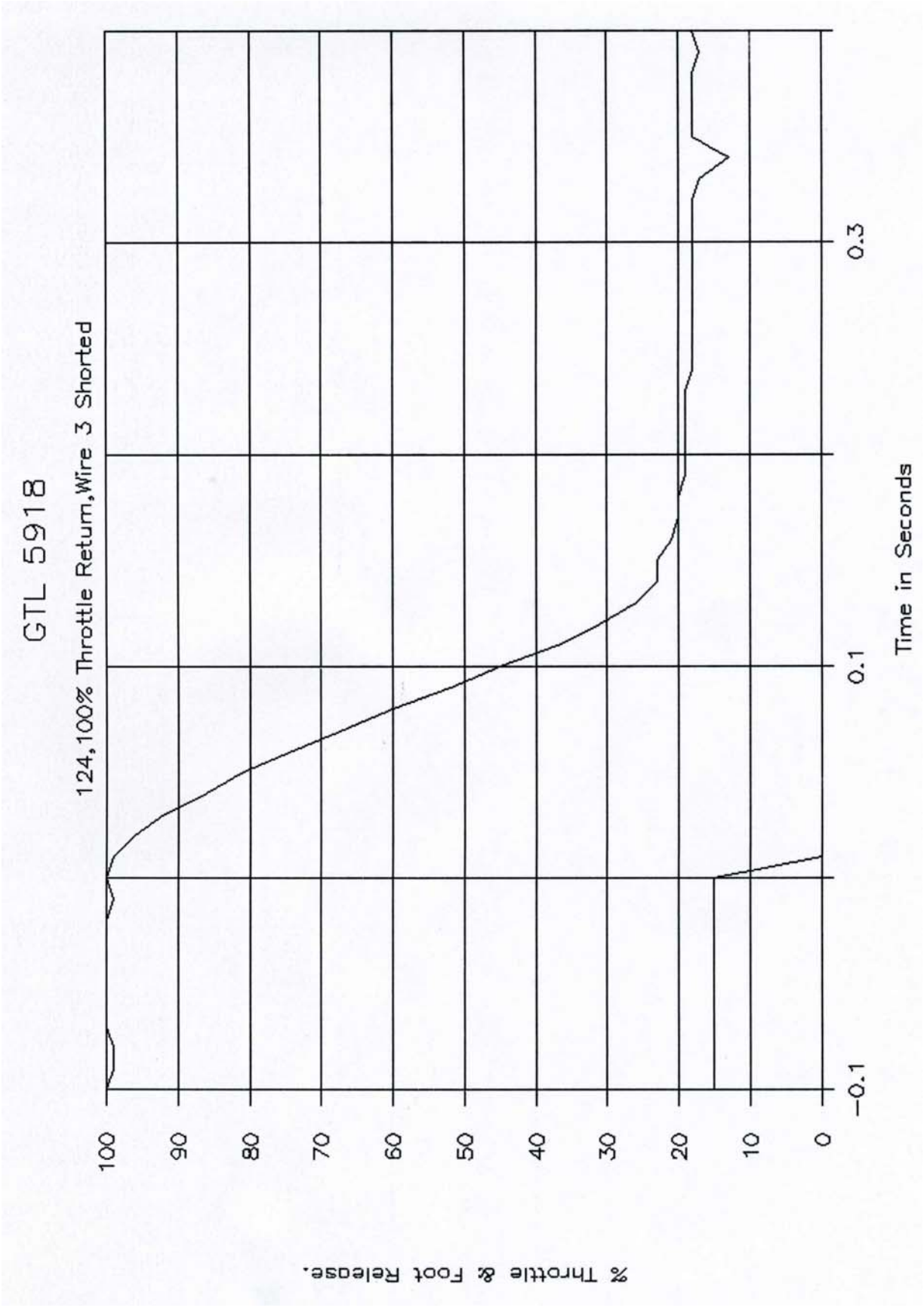

GTL 5913
124, 100% Throttle Return,Wire 4 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

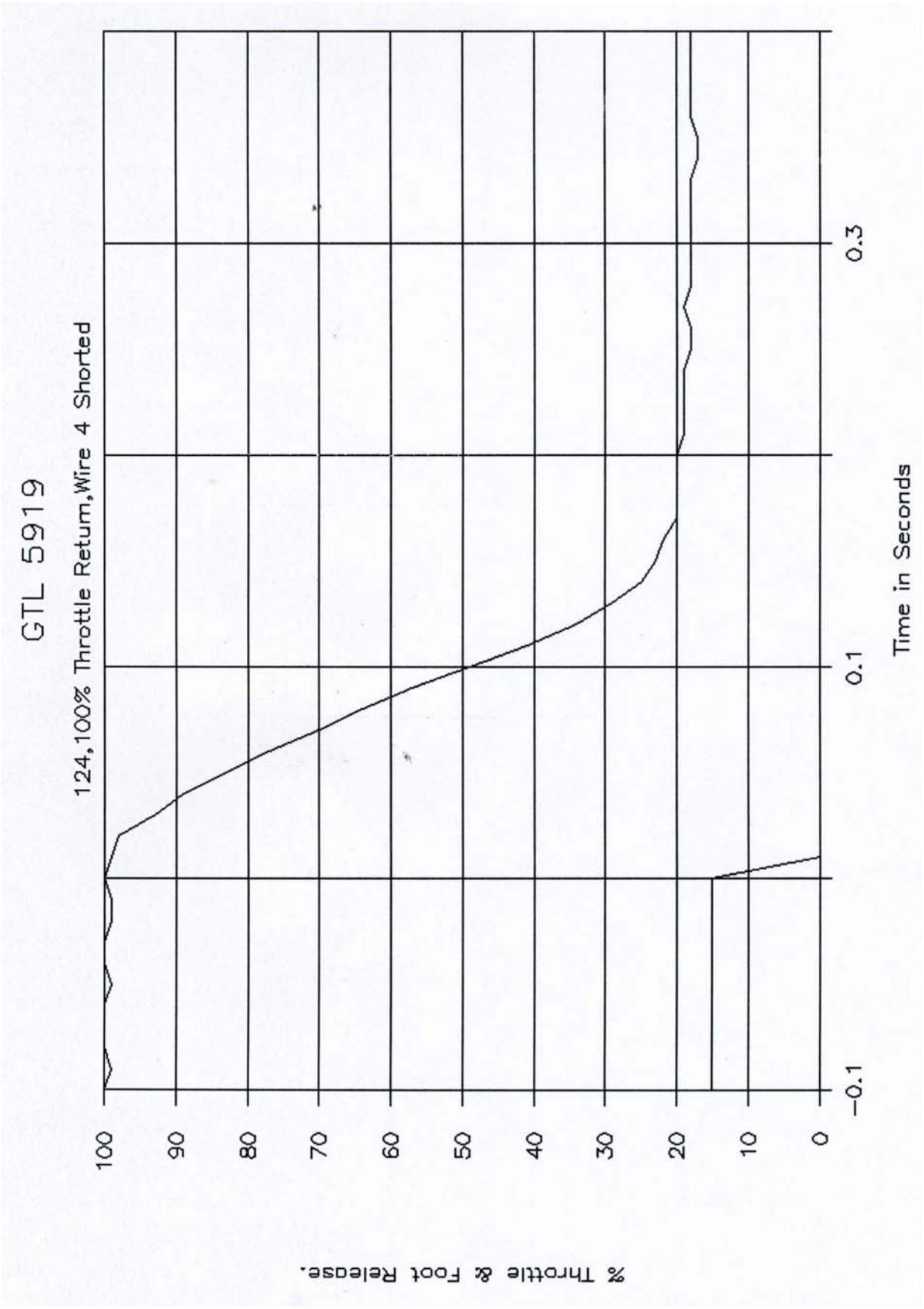

GTL 5914
124, 100% Throttle Return,Wire 5 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

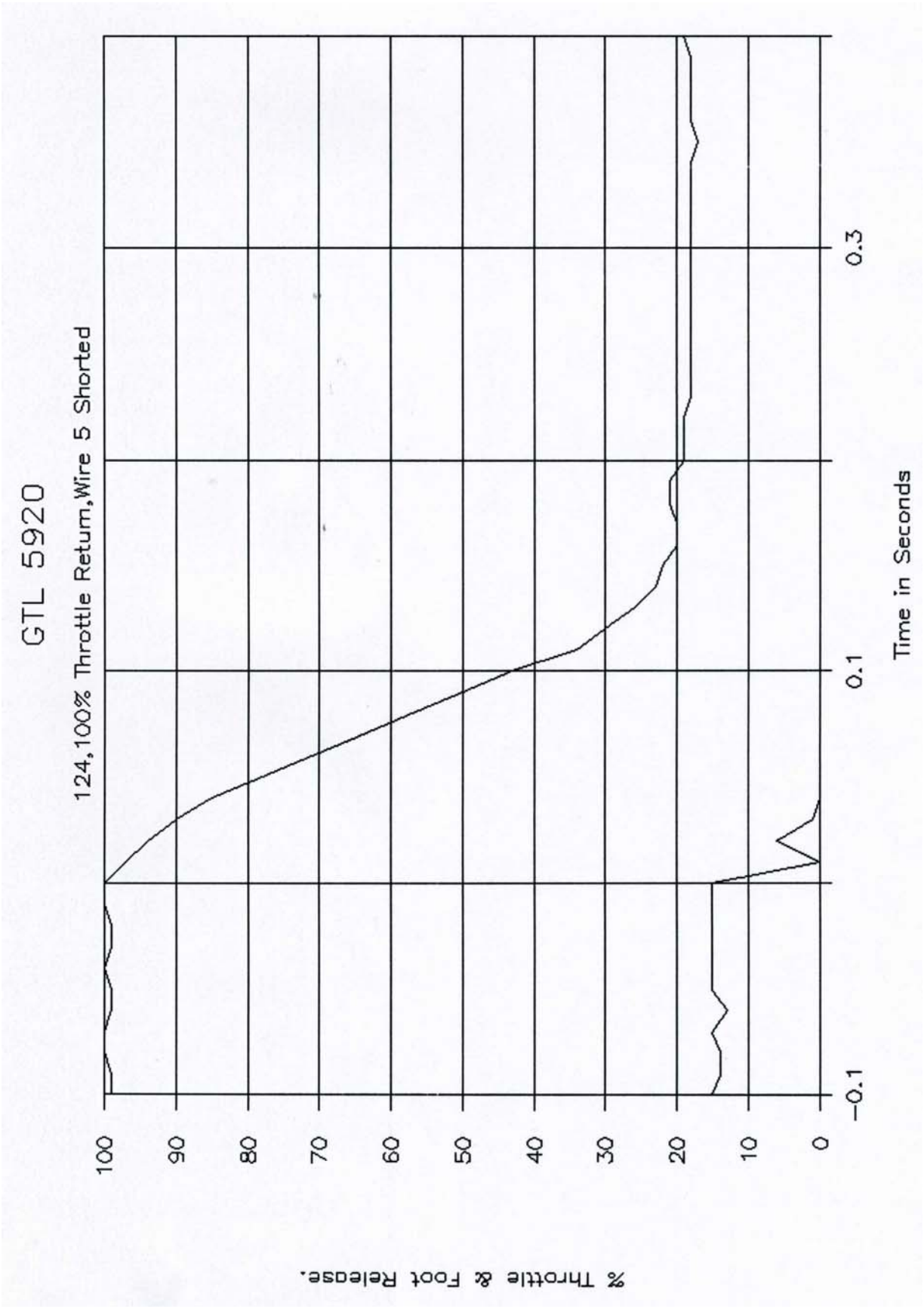

GTL 5915
124, 100% Throttle Return,Wire 6 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

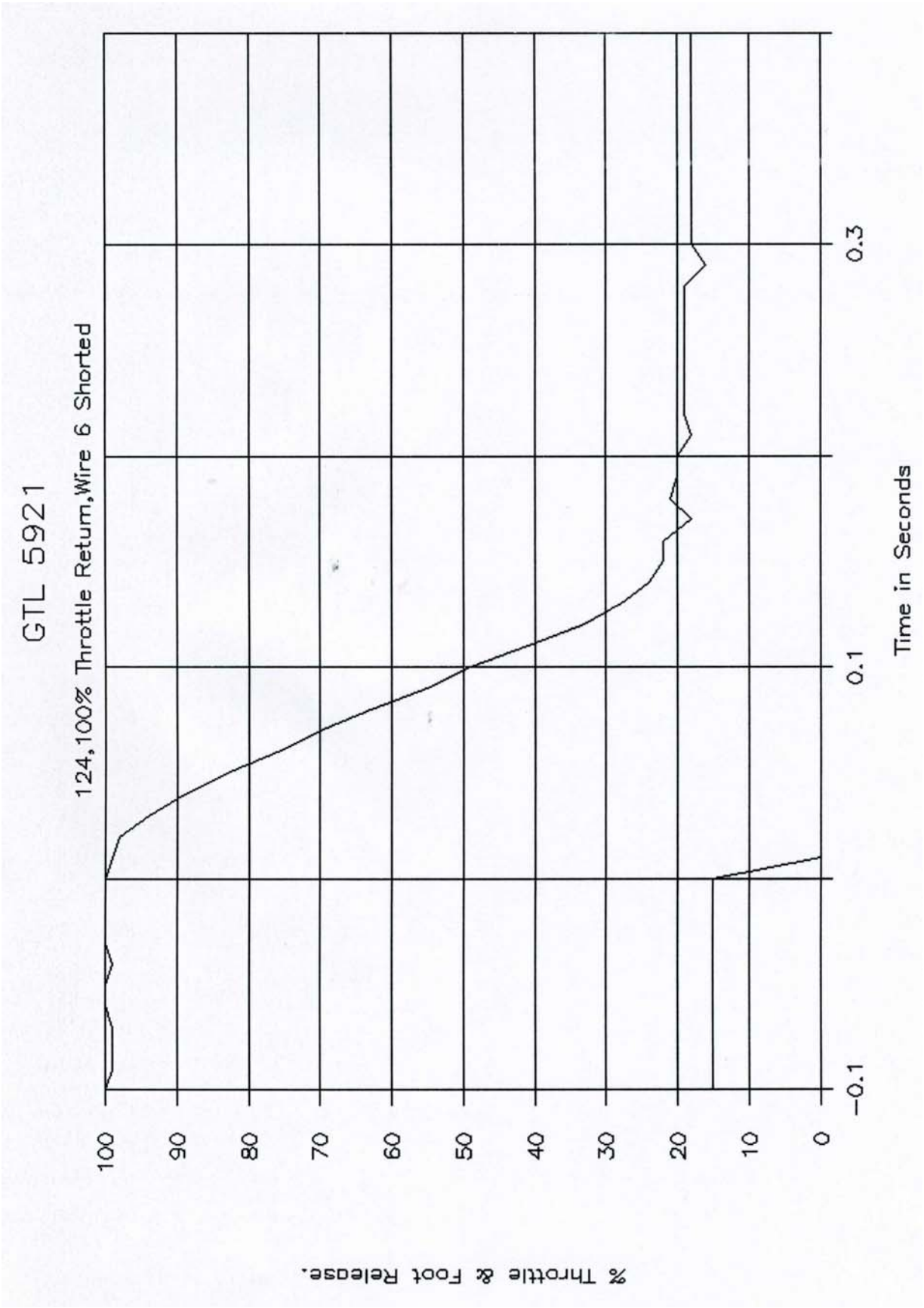

GTL 5916
124,100% Throttle Return,Wire 1 Shorted
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

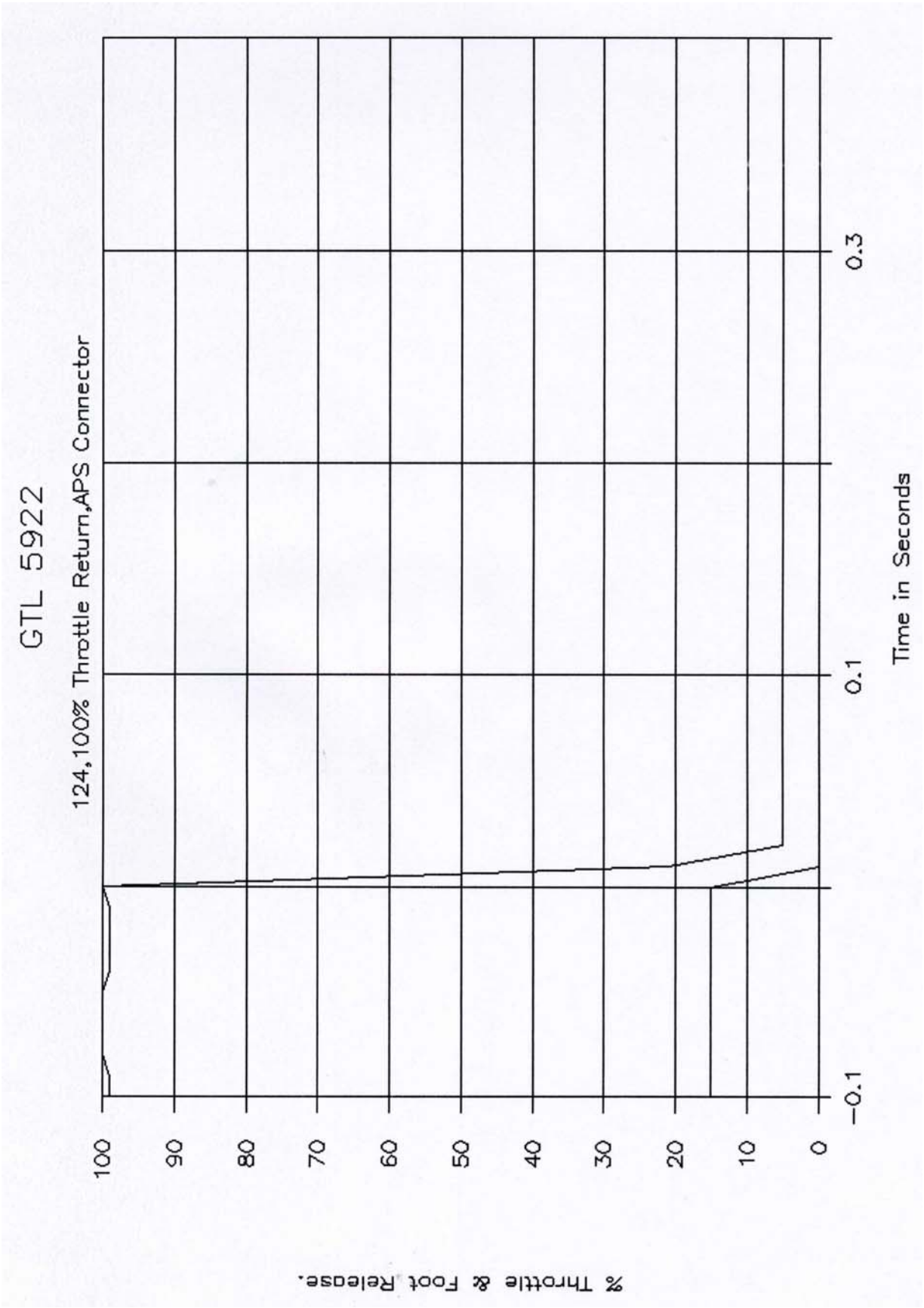

GTL 5917
124,100% Throttle Return,Wire 2 Shorted
% Throttle & Foot Release
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds


GTL 5918
124,100% Throttle Return,Wire 3 Shorted
% Throttle & Foot Release
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds


GTL 5919
124,100% Throttle Return,Wire 4 Shorted
% Throttle & Foot Release
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds


GTL 5920
124,100% Throttle Return,Wire 5 Shorted
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds


GTL 5921
124,100% Throttle Return,Wire 6 Shorted
% Throttle & Foot Release
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds


GTL 5922
124,100% Throttle Return,APS Connector
% Throttle & Foot Release
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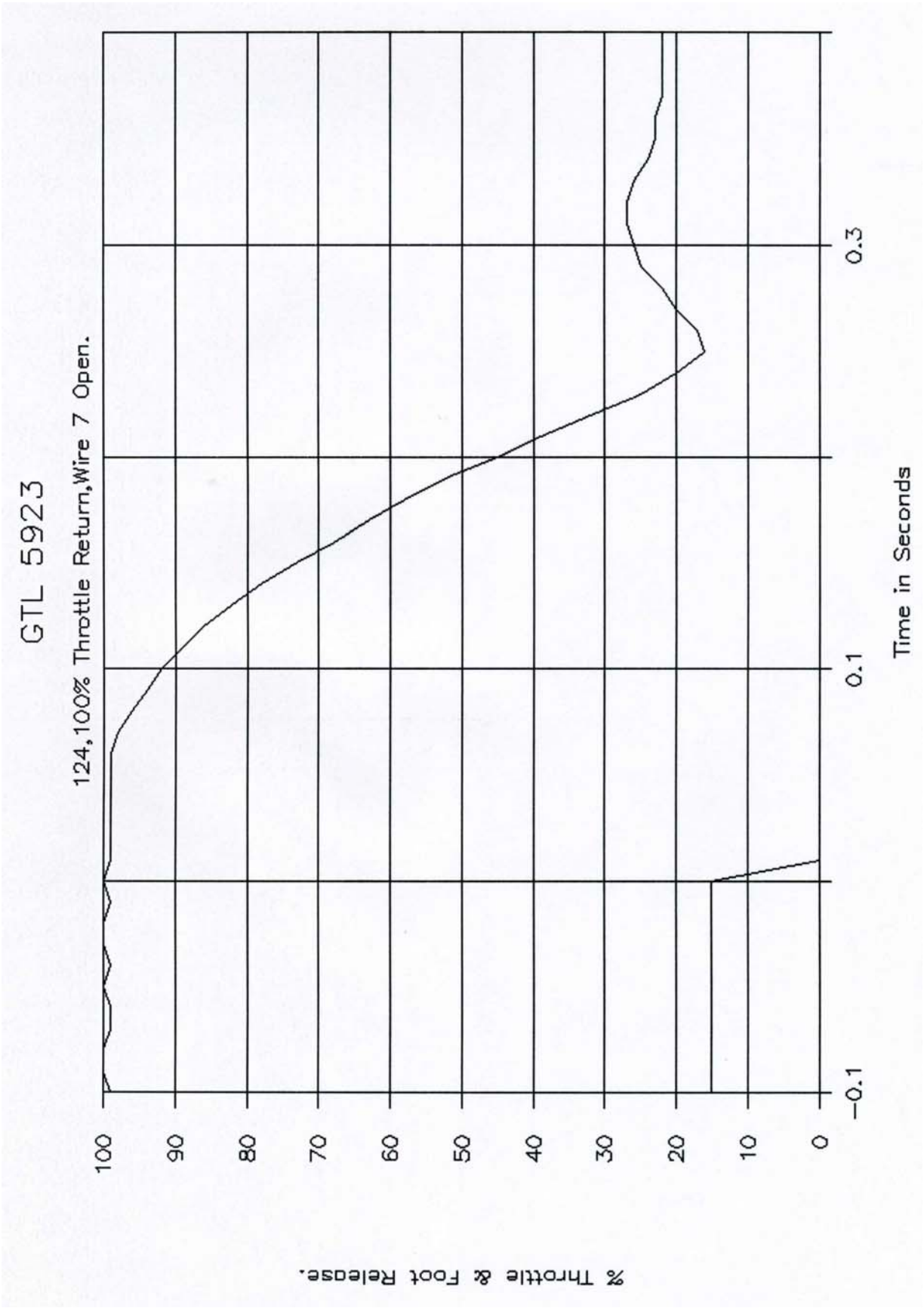
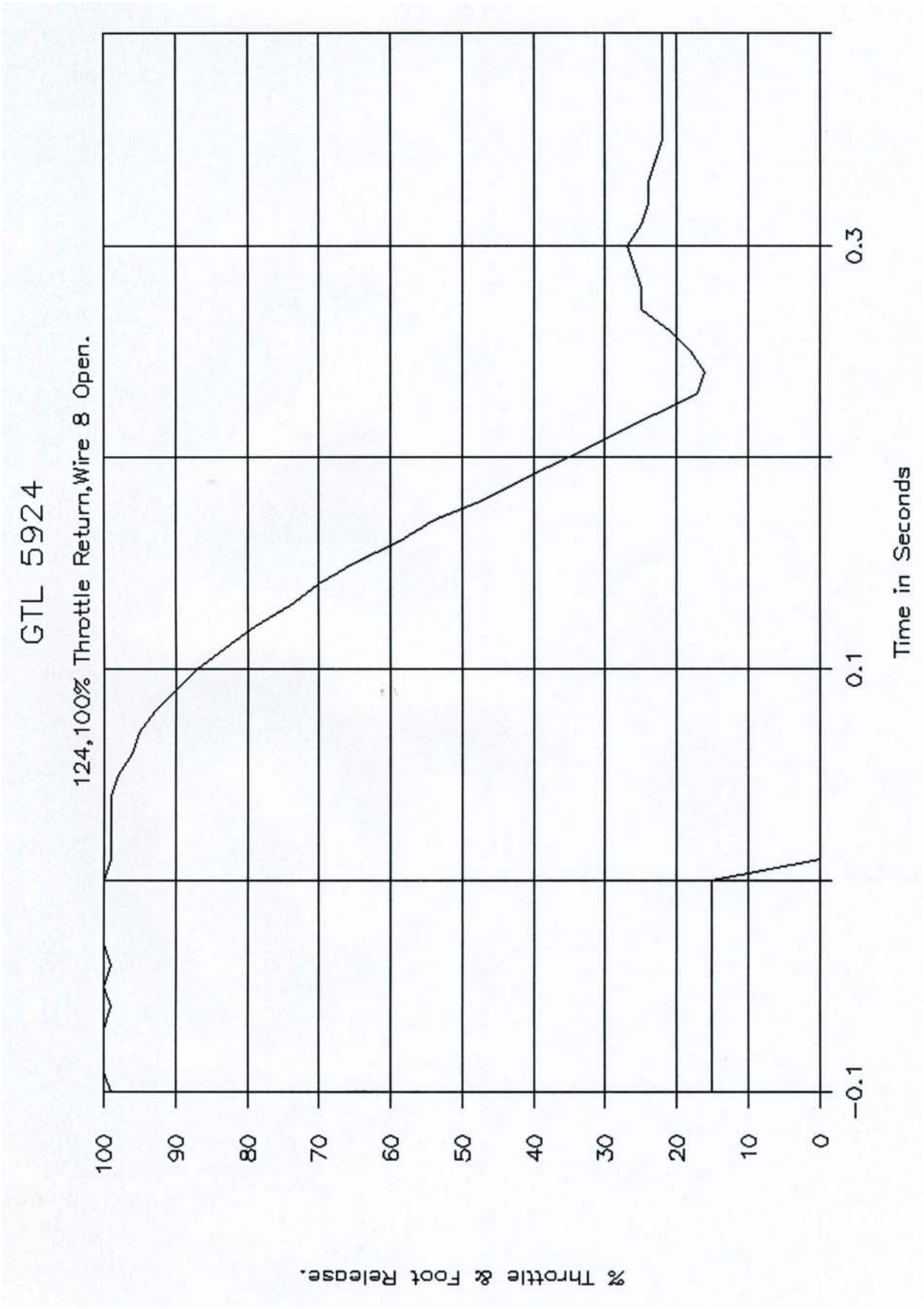
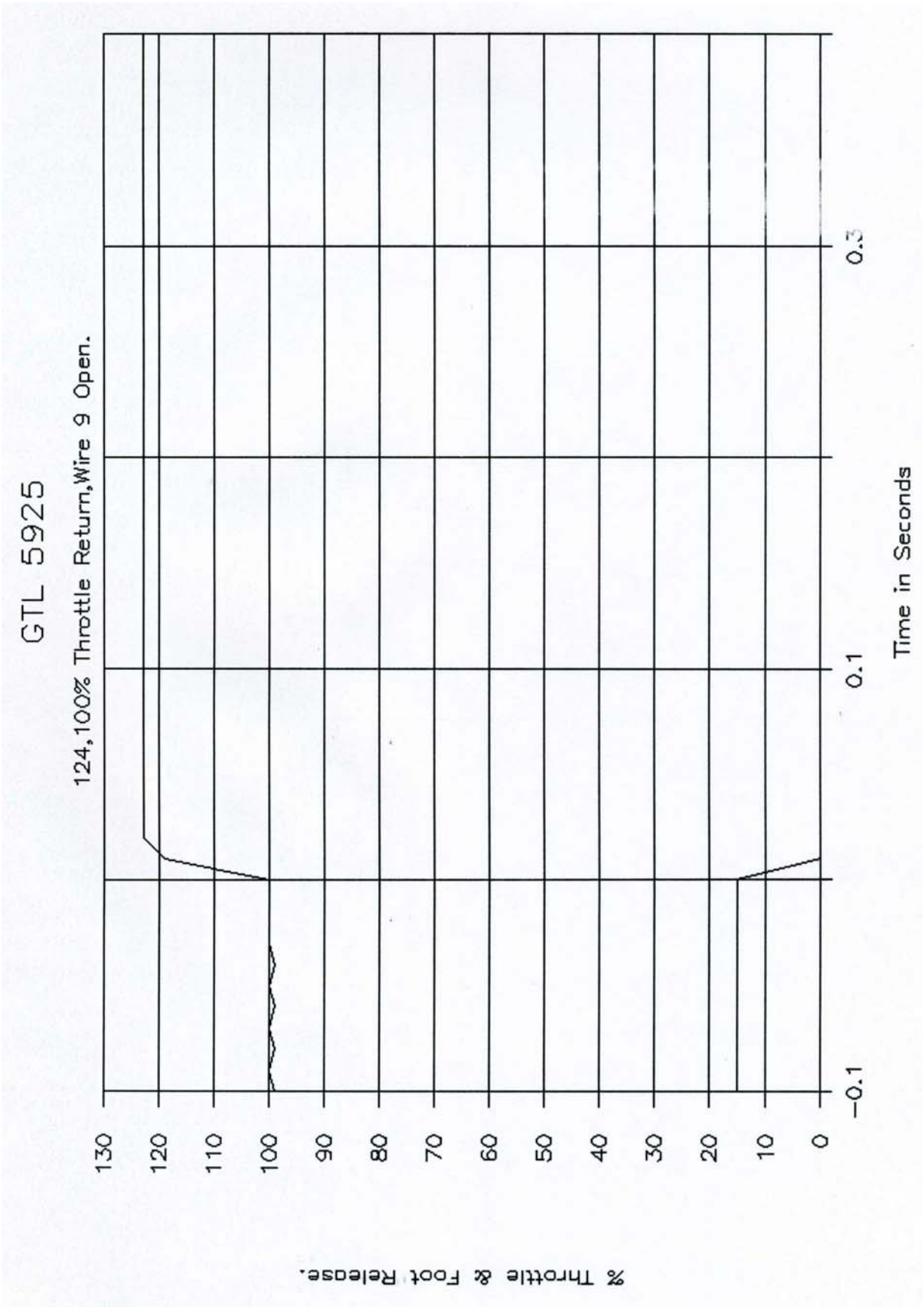
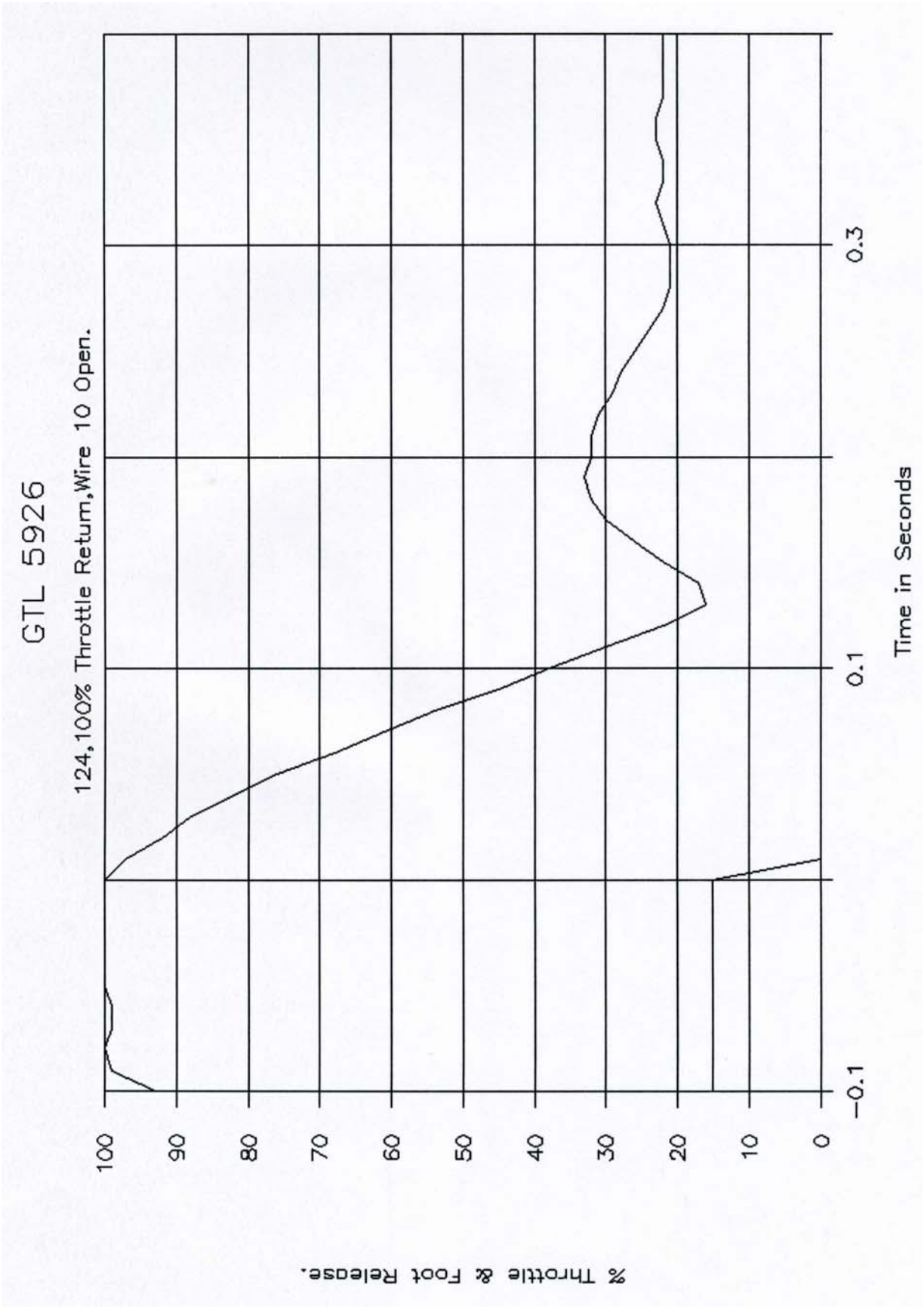
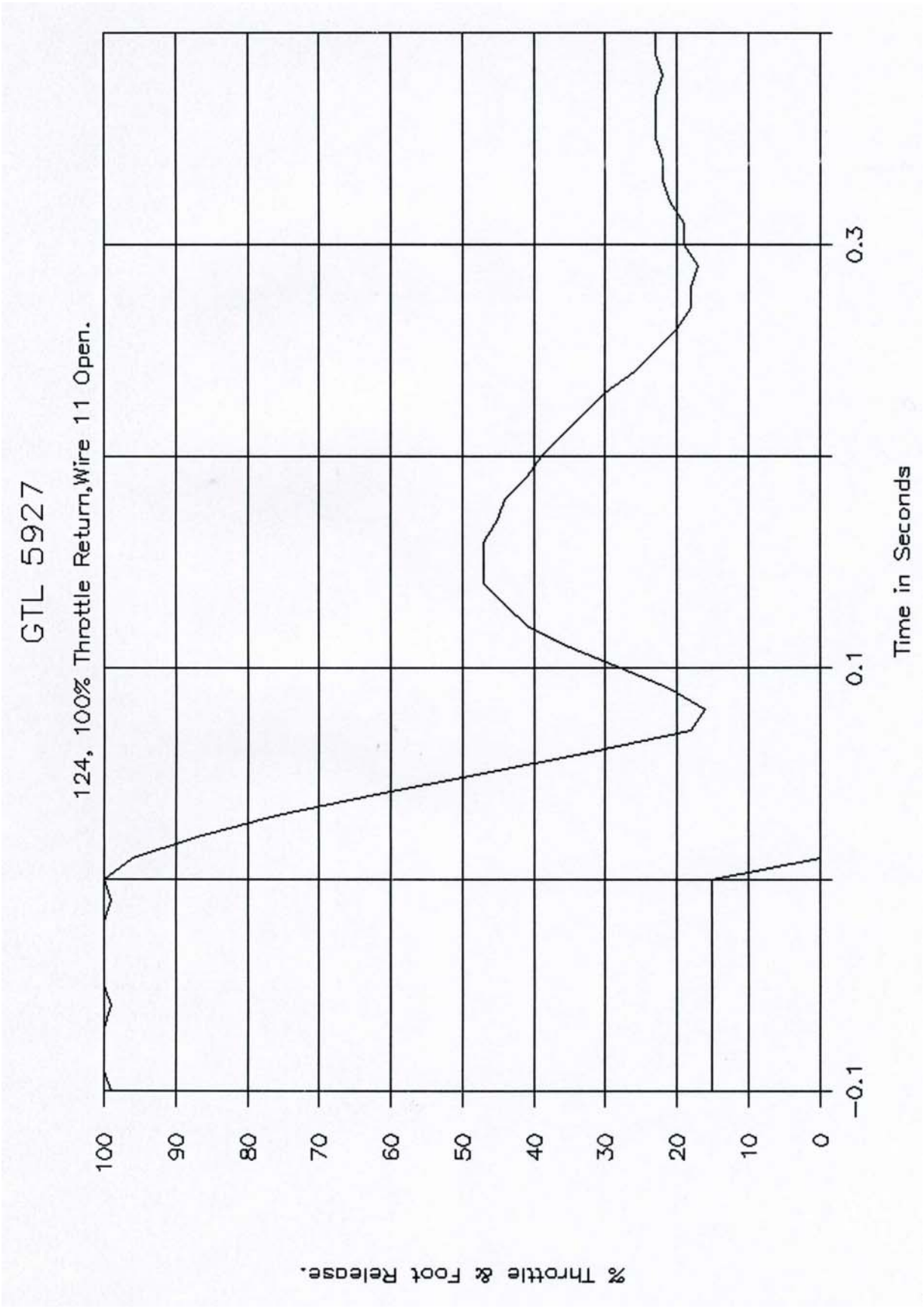
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

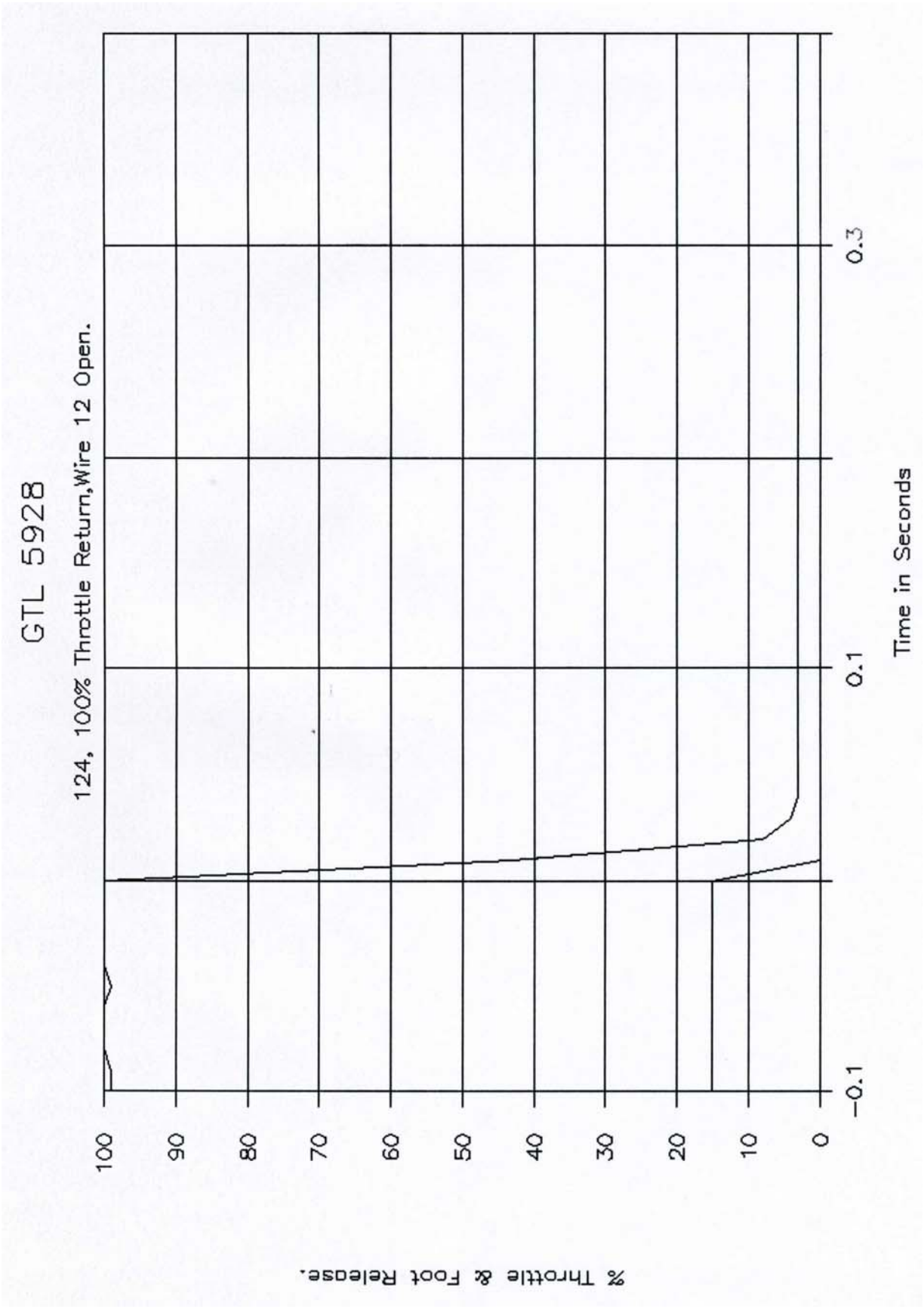

GTL 5923
124,100% Throttle Return,Wire 7 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

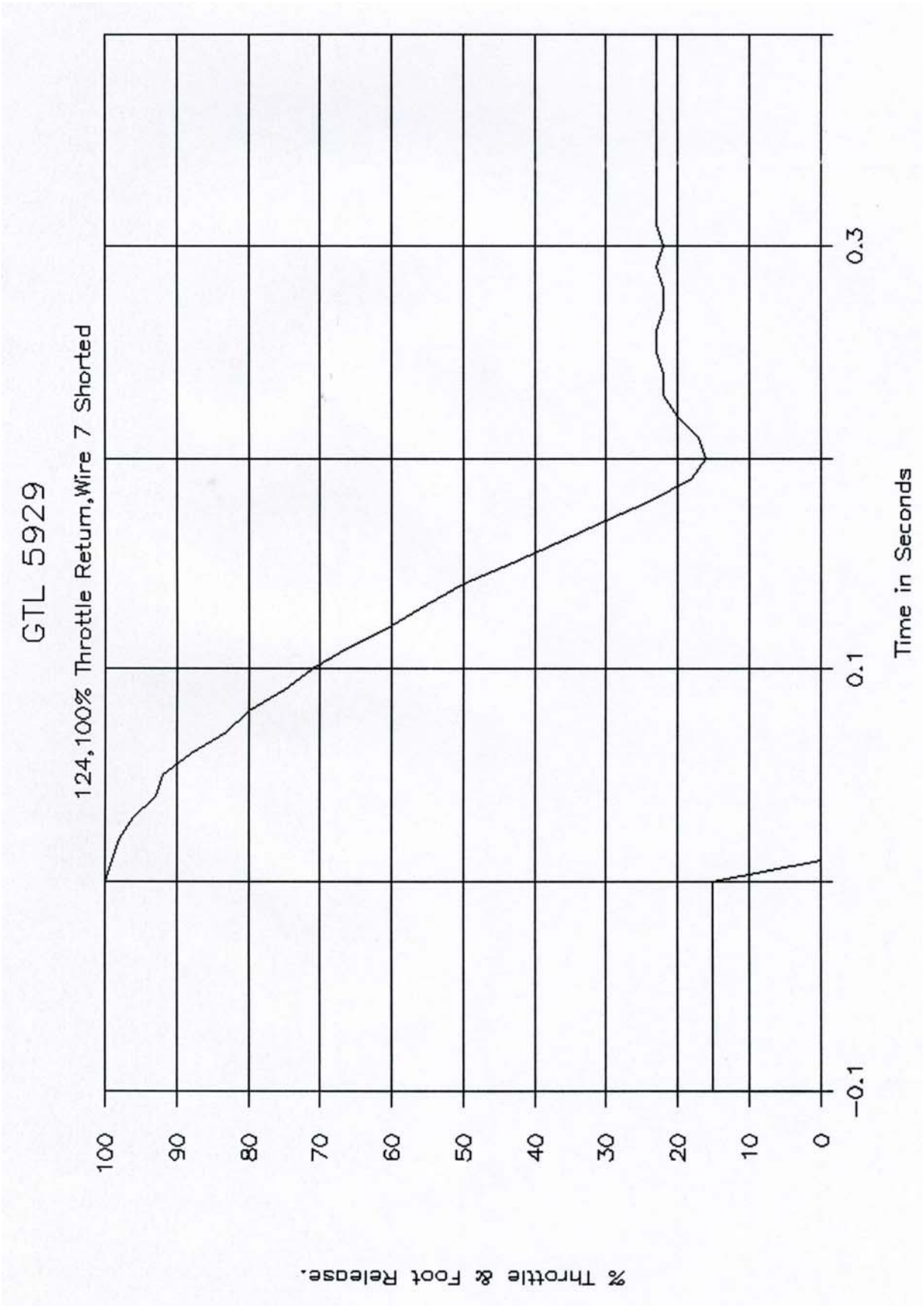

GTL 5924
124,100% Throttle Return,Wire 8 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

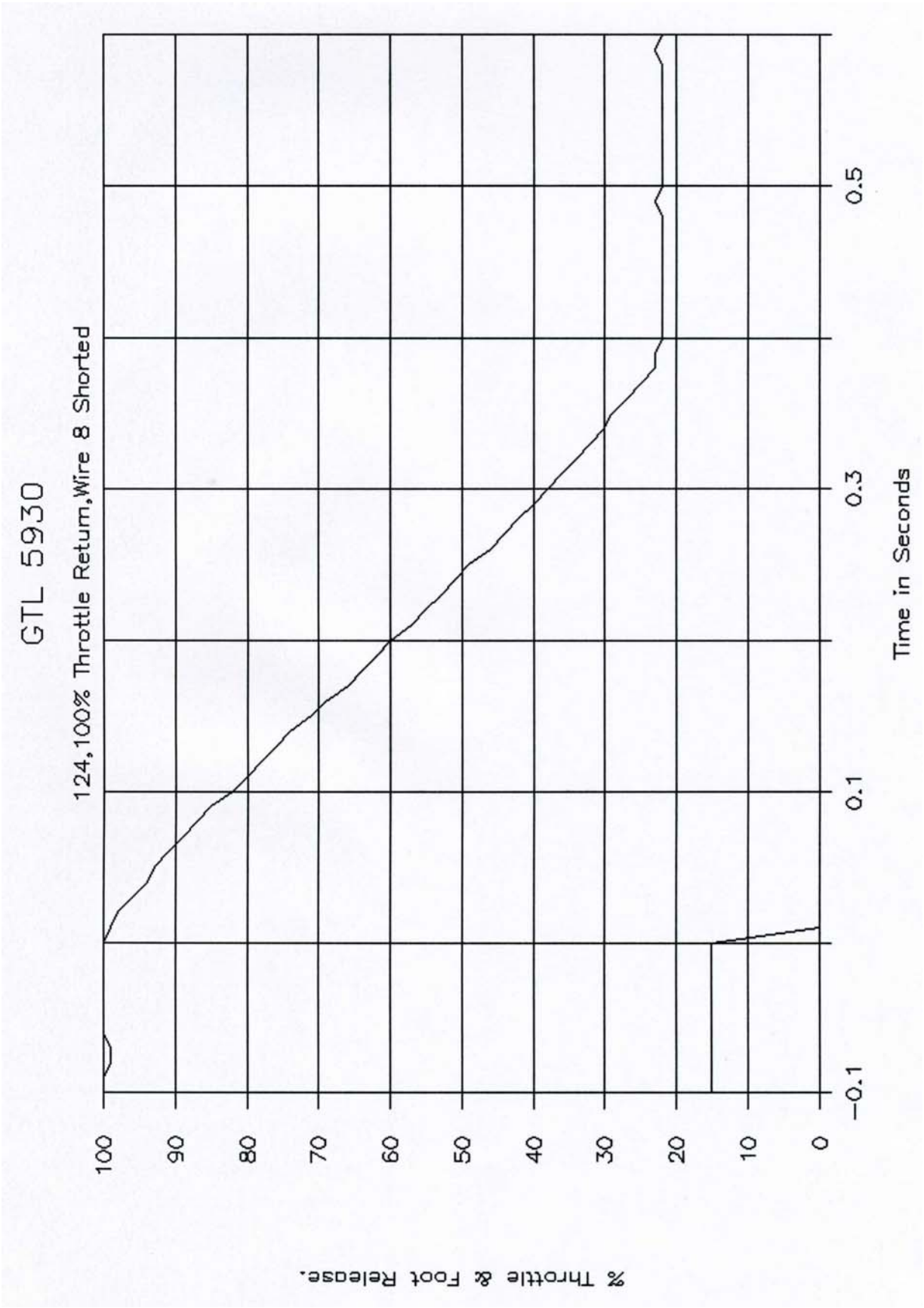

GTL 5925
124,100% Throttle Return,Wire 9 Open.
% Throttle & Foot Release.
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

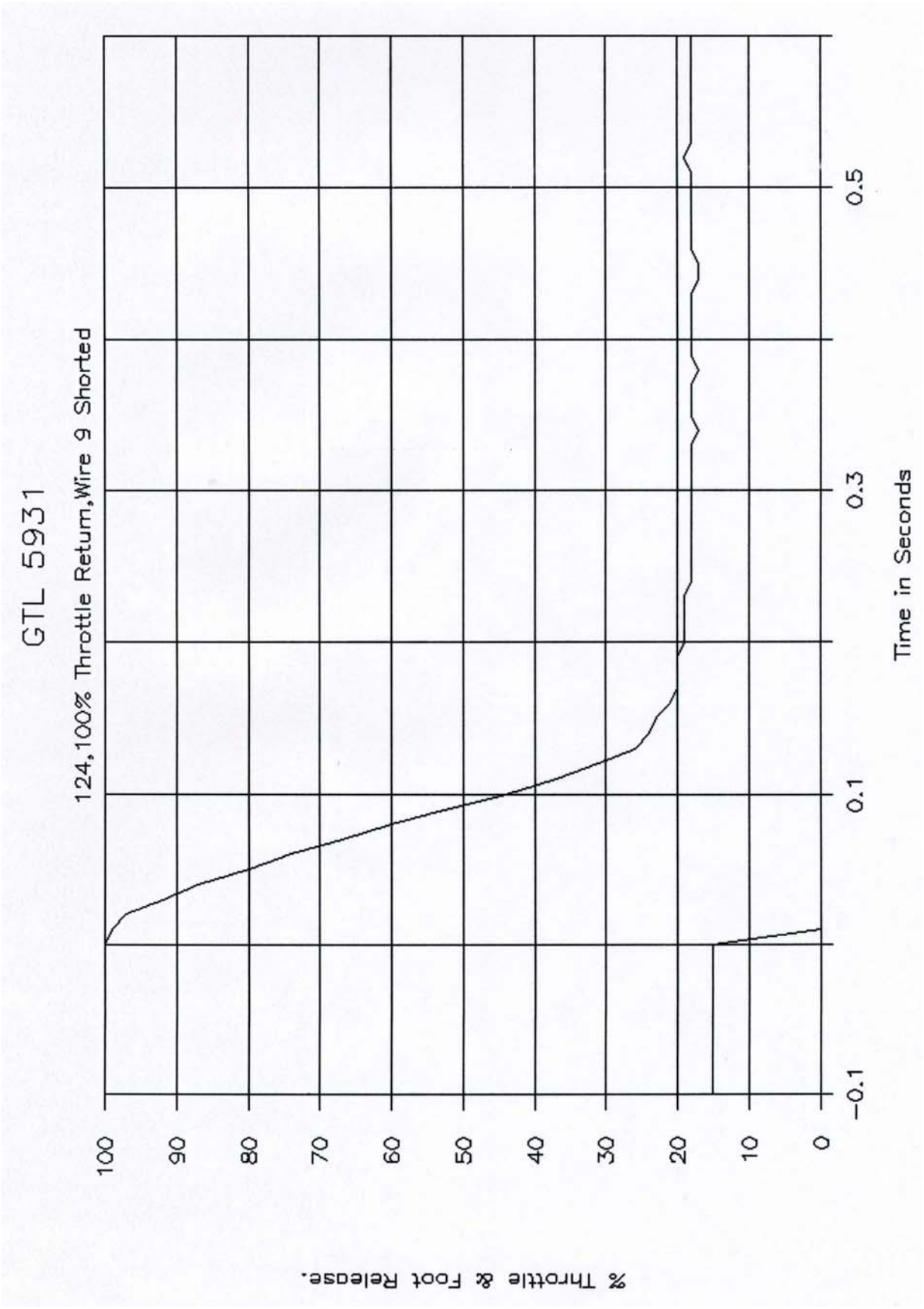

GTL 5926
124,100% Throttle Return,Wire 10 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

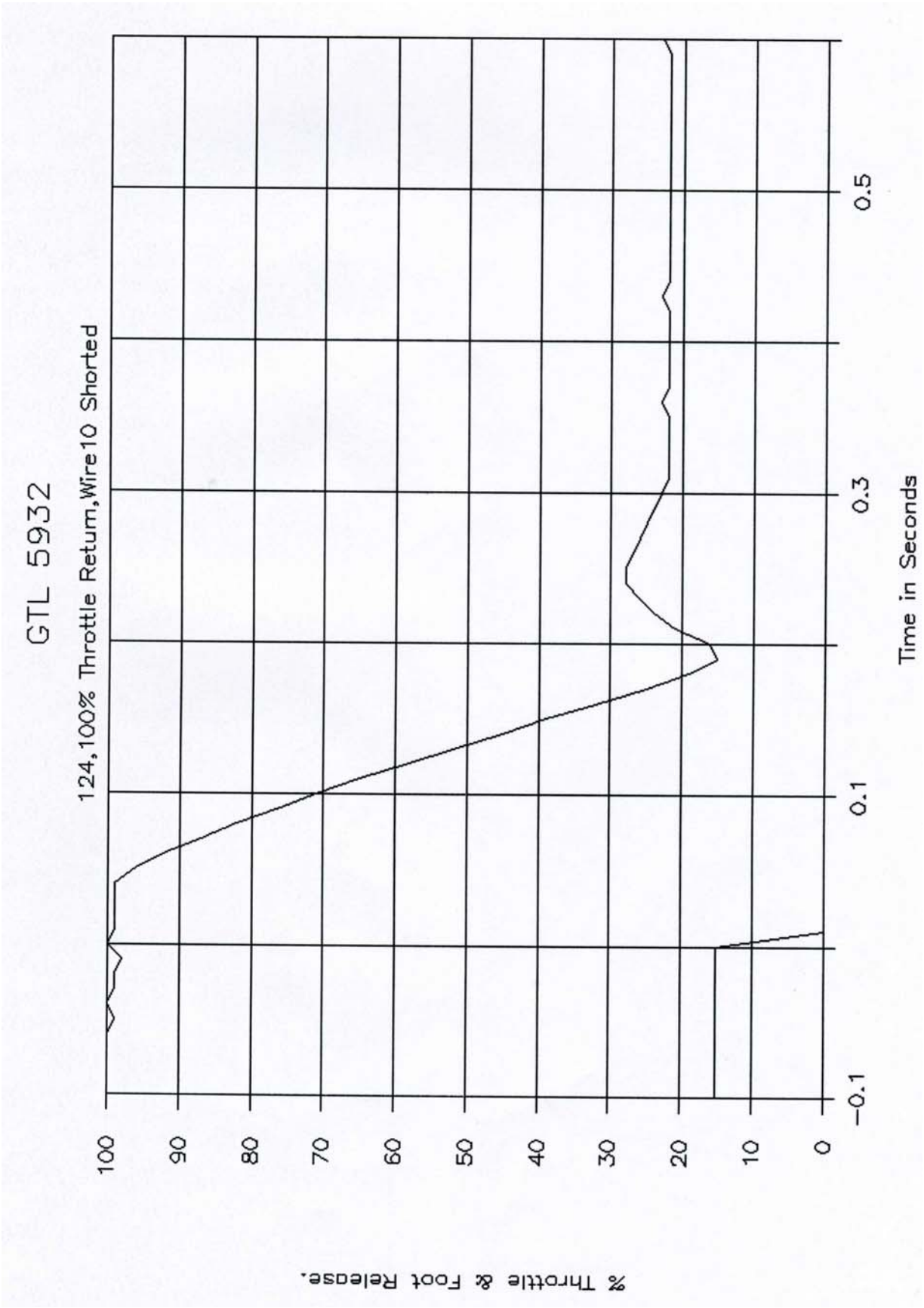

GTL 5927
124, 100% Throttle Return,Wire 11 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

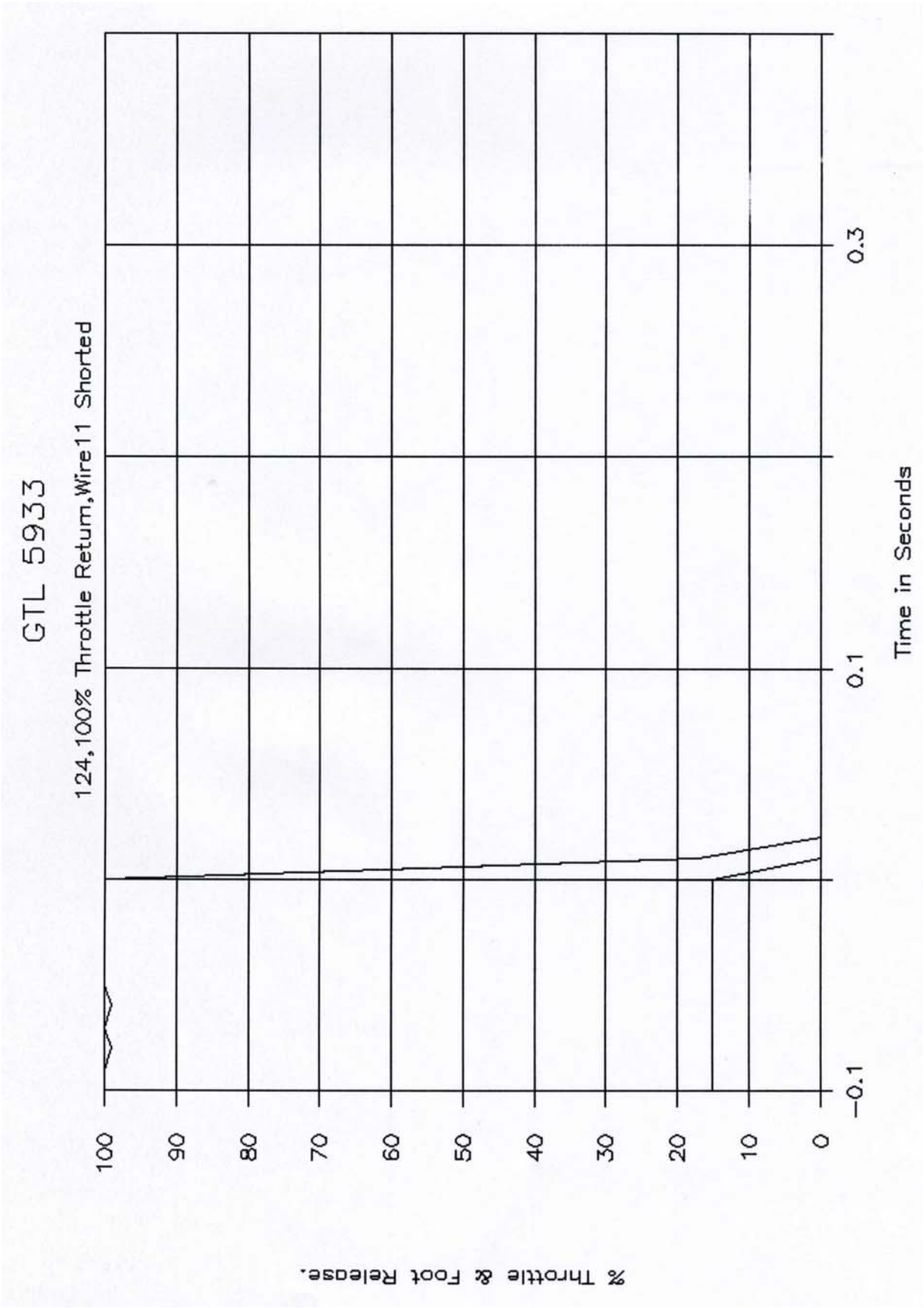

GTL 5928
124, 100% Throttle Return,Wire 12 Open.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

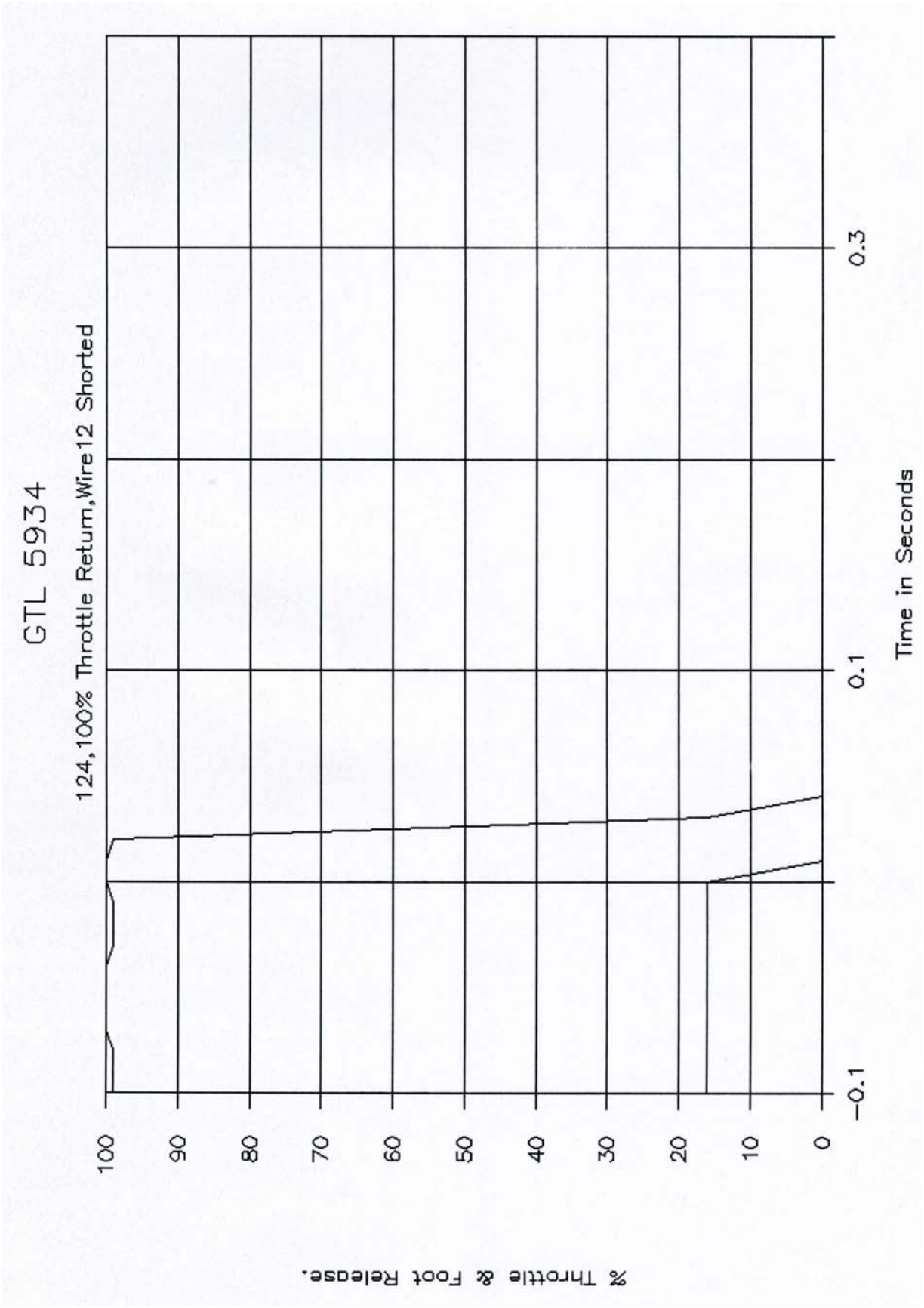

GTL 5929
124,100% Throttle Return,Wire 7 Shorted
% Throttle & Foot Release
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds

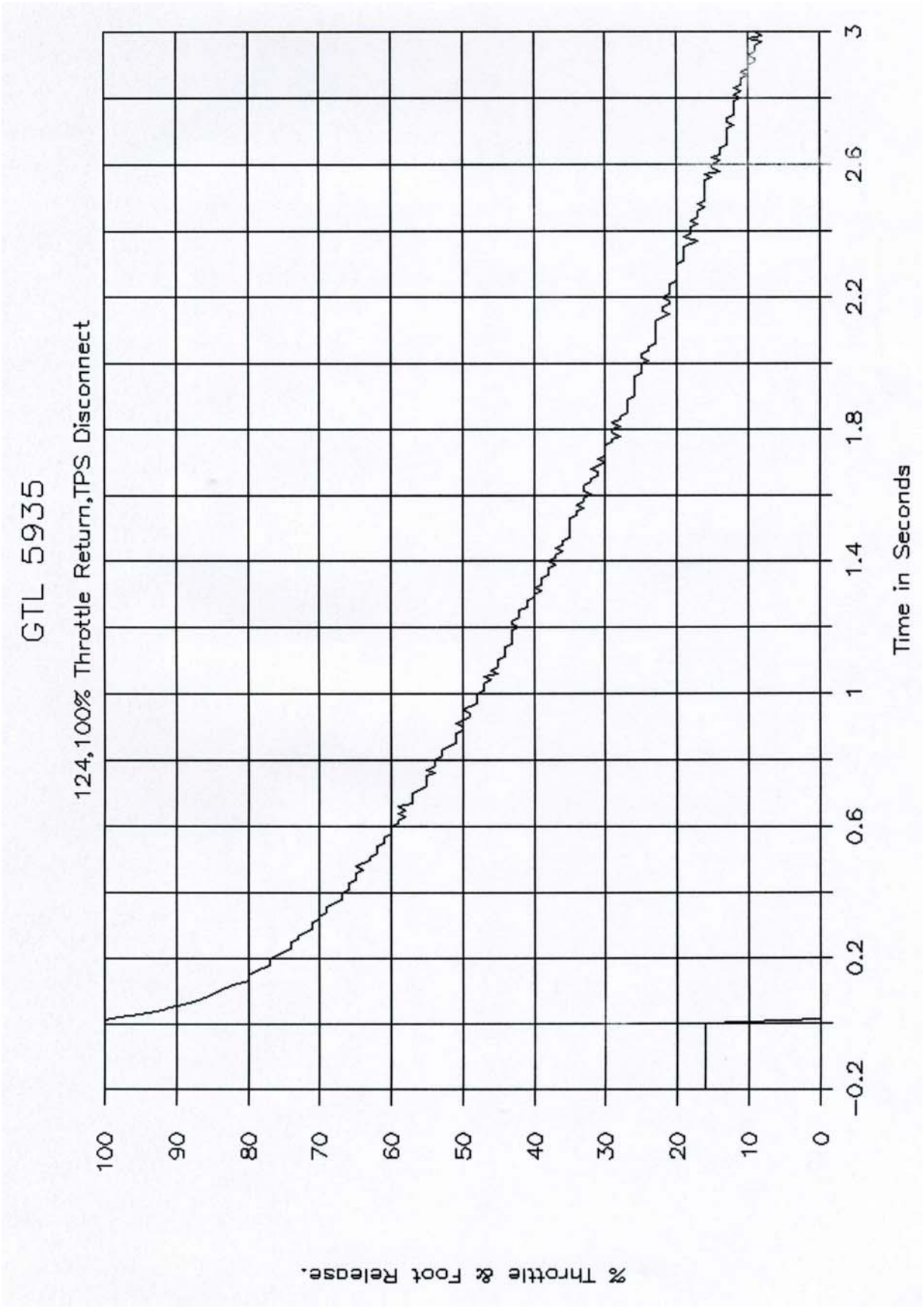

GTL 5930
124,100% Throttle Return,Wire 8 Shorted
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
0.5
Time in Seconds


GTL 5931
124,100% Throttle Return,Wire 9 Shorted
% Throttle & Foot Release
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
0.5
Time in Seconds


GTL 5932
124,100% Throttle Return,Wire10 Shorted
% Throttle & Foot Release
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
0.5
Time in Seconds


GTL 5933
124,100% Throttle Return,Wire11 Shorted
% Throttle & Foot Release
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds


GTL 5934
124,100% Throttle Return,Wire12 Shorted
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.1
0.1
0.3
Time in Seconds


GTL 5935
124,100% Throttle Return,TPS Disconnect
% Throttle & Foot Release
100
90
80
70
60
50
40
30
20
10
0
-0.2
0.2
0.6
1
1.4
1.8
2.2
2.6
3
Time in Seconds

SECTION 7
MANUFACTURER'S DRAWINGS

VEHICLE INFORMATION/TEST SPECIFICATIONS
FMVSS 124 - Accelerator Control Systems

Requested Information:

1.) A sketch of the driver operated accelerator control system (ACS) starting from the accelerator pedal up to and including the fuel metering device (carburetor, fuel injectors, fuel distributor, or fuel injection pump).

Response 1.

The 2007 Toyota Tacoma has four ACSs: ACS with 2TR-FE engine and cruise control, ACS with 2TR-FE engine without cruise control, ACS with 1GR-FE engine and cruise control and ACS with 1GR-FE engine without cruise control. The driver operated ACS consists of the accelerator pedal, throttle body and cruise control. If the engine is the same, the accelerator pedal and the throttle body for ACS with cruise control and ACS without cruise control are the same. The sketches of the ACS are provided as Attachment 3. In addition, a sketch of the fuel system is provided as Attachment 4.

2.) For Normal ACS operation, the method utilized to determine the engine idle state (air throttle plate position, fuel delivery rate, other).

Response 2.

For Normal ACS operation, the method utilized to determine the engine idle state is the Throttle Valve Position. A sketch of the Throttle Valve is provided as drawing (B) in Attachment 5.

3.) For Fail-Safe operation of the ACS (disconnection or severance), the method utilized to determine return of engine power to the idle state (air throttle plate position, fuel delivery rate, air intake, engine rpm, other)

Response 3.

For Fail-Safe operation of the ACS (disconnection or severance), the method utilized to determine return of engine power to the idle state is the throttle body return spring and throttle control motor, shown as drawing (D) in Attachment 5.

4.) Is the vehicle ACS equipped with any of the following:
   A. Accelerator Pedal Position Sensor (APS)
   B. Throttle Plate Position Sensor (TPS)
   C. Electronic Control Module (ECM)
   D. Air throttle plate actuator motor

Response 4.
The 2007 Toyota Tacoma ACS is equipped with APS, TPS, ECM and Air throttle plate actuator motor, as shown in Attachment 5.

5.) If air throttle plate equipped, is there a procedure which can be utilized by the test laboratory to measure the position of the throttle plate by tapping into the TPS or ECM? If so, please describe.

Response 5.
The 2007 Toyota Tacoma is equipped with the air throttle plate. We normally call the air throttle plate "the throttle valve". A sketch of the air throttle plate (i.e.; throttle valve) is provided as drawing (B) in Attachment 5. The procedure that can be utilized by the test laboratory to measure the position of the throttle plate (i.e.; throttle valve) by tapping into the ECM is provided as Attachment 6.

6.) Point(s) chosen to demonstrate compliance with FMVSS 124 for single point disconnect and severance.

Response 6.
We choose 4 points (i.e.; two accelerator pedal springs, one throttle body return spring and one throttle control motor) to demonstrate compliance with FMVSS 124. The procedure for removing the accelerator pedal spring is provided as Attachment 7-1. The spring inside the electrical throttle body and throttle control motor are not possible to cut or remove, as shown in Attachment 7-2.

7.) Where applicable, were connections in the ACS beyond the ECM such as the fuel injectors tested for disconnection and severance. If yes, provide details.

Response 7.
The connections in the ACS beyond the ECM such as the fuel injectors weren't tested for disconnection and severance.

8.) Where applicable, were idle return times tested for electrical severance accompanied by shorting to ground? If yes, please provide details.

Response 8.
The idle return times weren't tested for electrical severance accompanied by shorting to ground.

9.) All sources of return energy (springs) for the accelerator pedal and if applicable, the air throttle plate.

Response 9.
The 2007 Toyota Tacoma has 2 sources of energy (i.e.; two accelerator pedal springs, throttle body return spring and throttle control motor) capable of returning the throttle to the idle. Details on the energy sources are provided as Attachment 8.

10.) If fuel delivery rate is used to demonstrate return to idle state, provide:
A. The method used to measure this signal i.e. connection to standard SAE J1587 data bus.
B. Equipment required to measure signal.
C. Fuel rate signal output range at the idle state.

Response 10.
The fuel delivery rate isn't used to demonstrate return to idle state.

11.) Is the ACS equipped with a limp home mode? If yes, provide operation description.

Response 11.
Yes, the ACS is equipped with a limp home mode, as shown in Attachment 9.

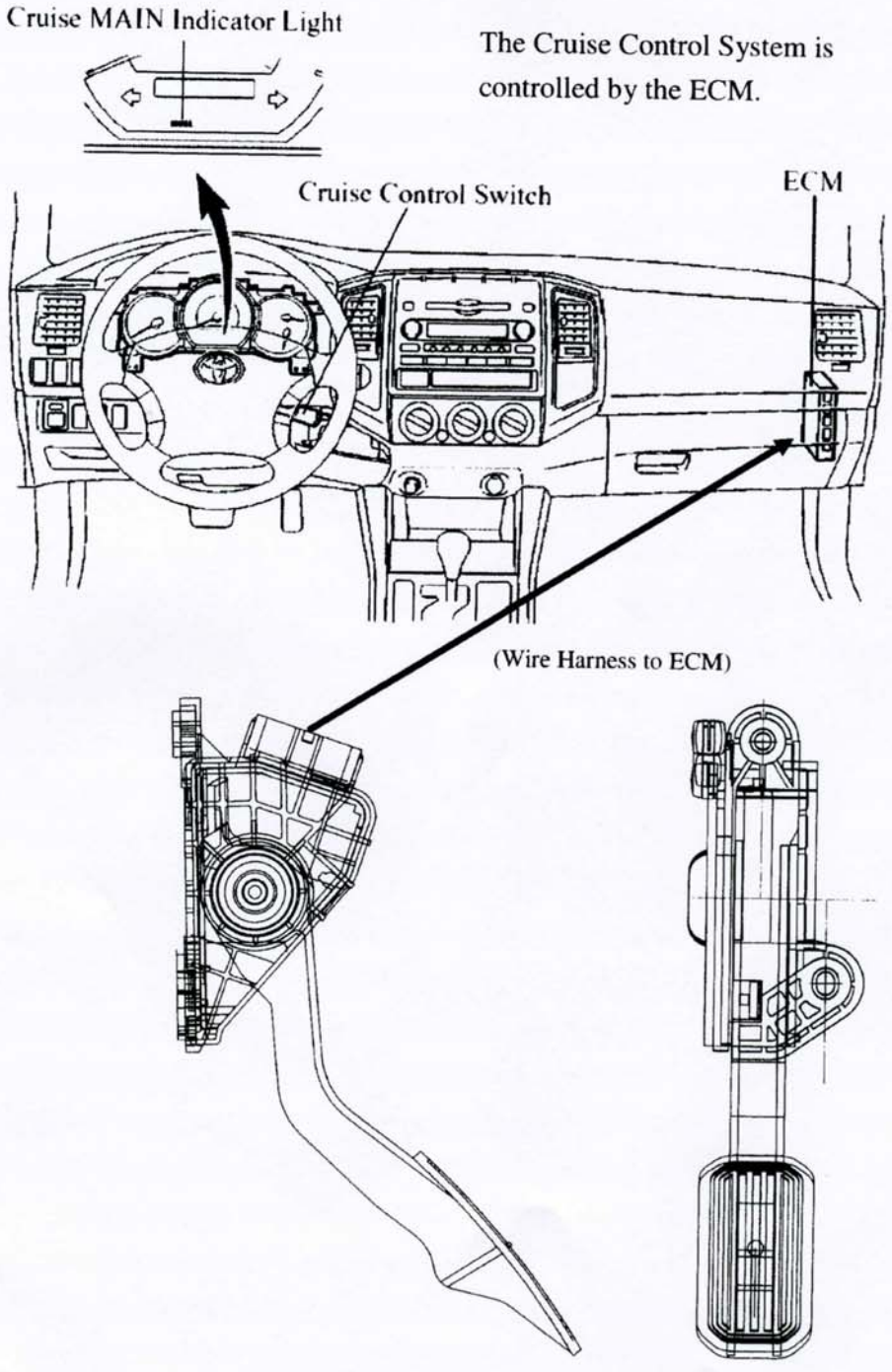
12.) Method by which the test laboratory can record engine RPM by connection to ECM, OBD connector, etc.

Response 12.
The method for recording engine RPM is provided as Attachment 10.

Attachment 3
Page 1 of 2

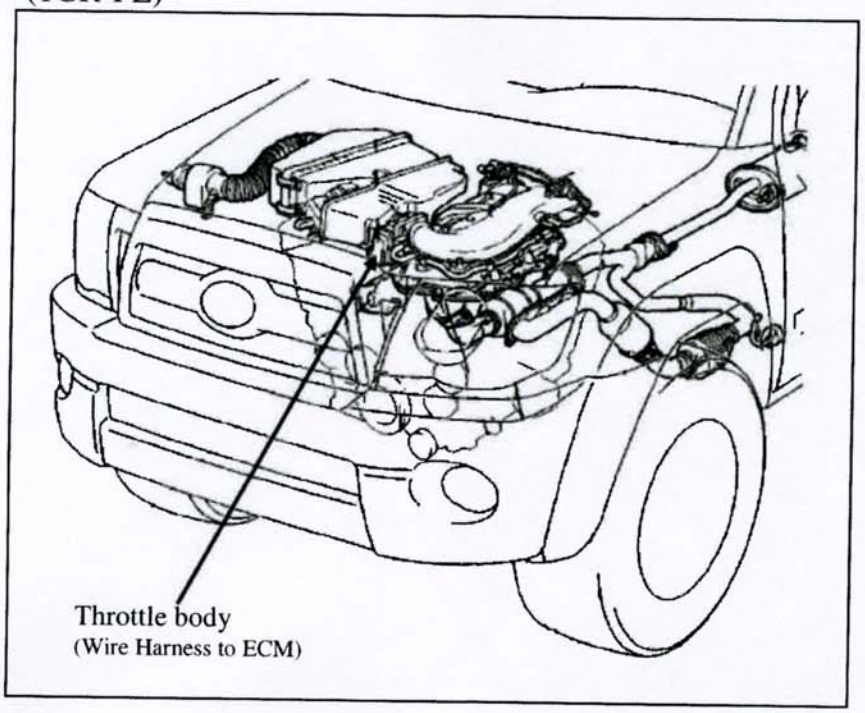
Accelerator Control System

<Accelerator pedal>

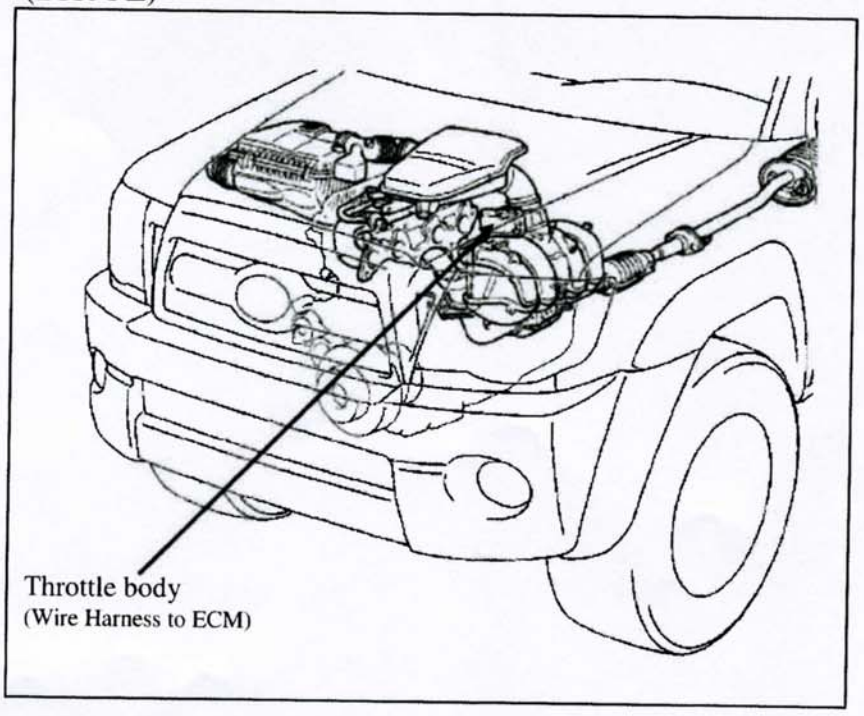


<Throttle Body>

(1GR-FE)

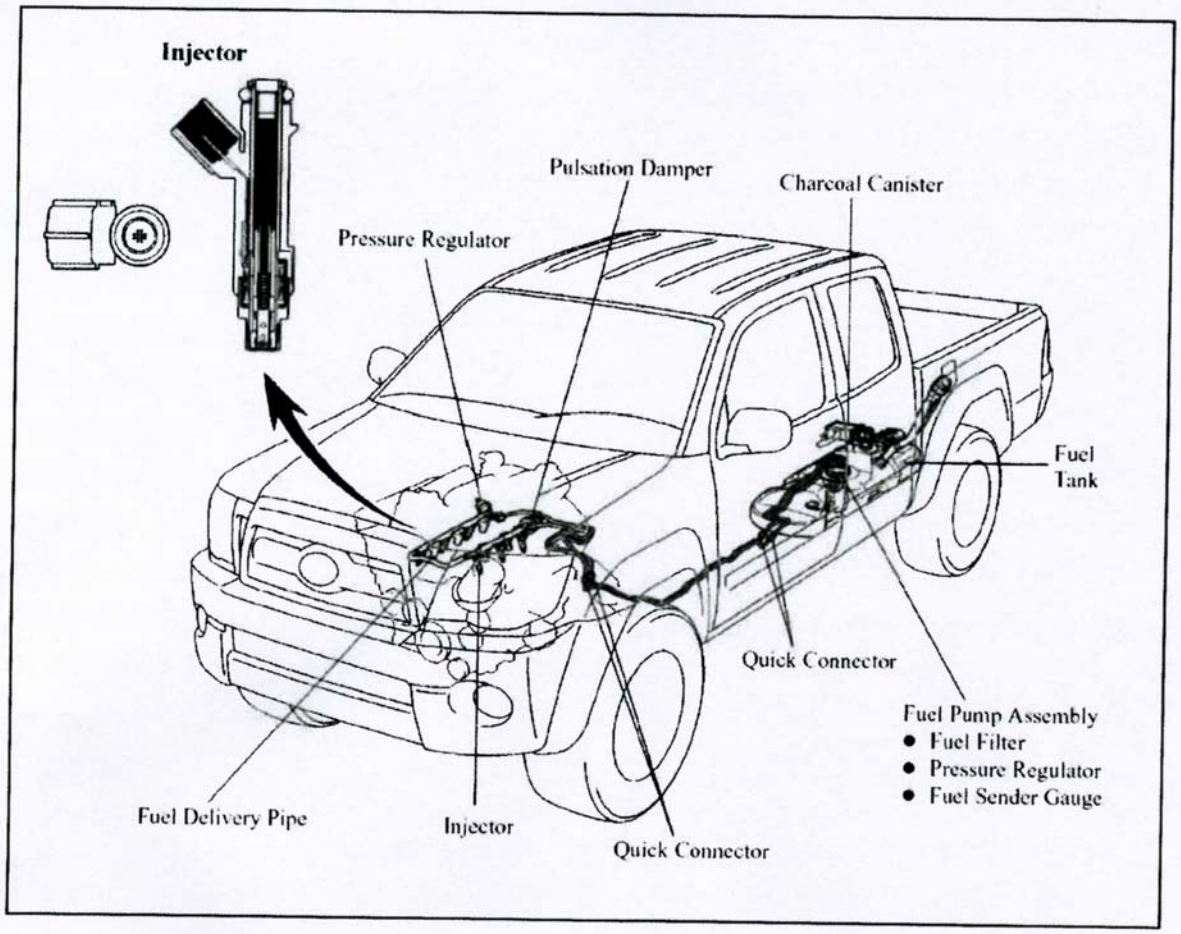


(2TR-FE)

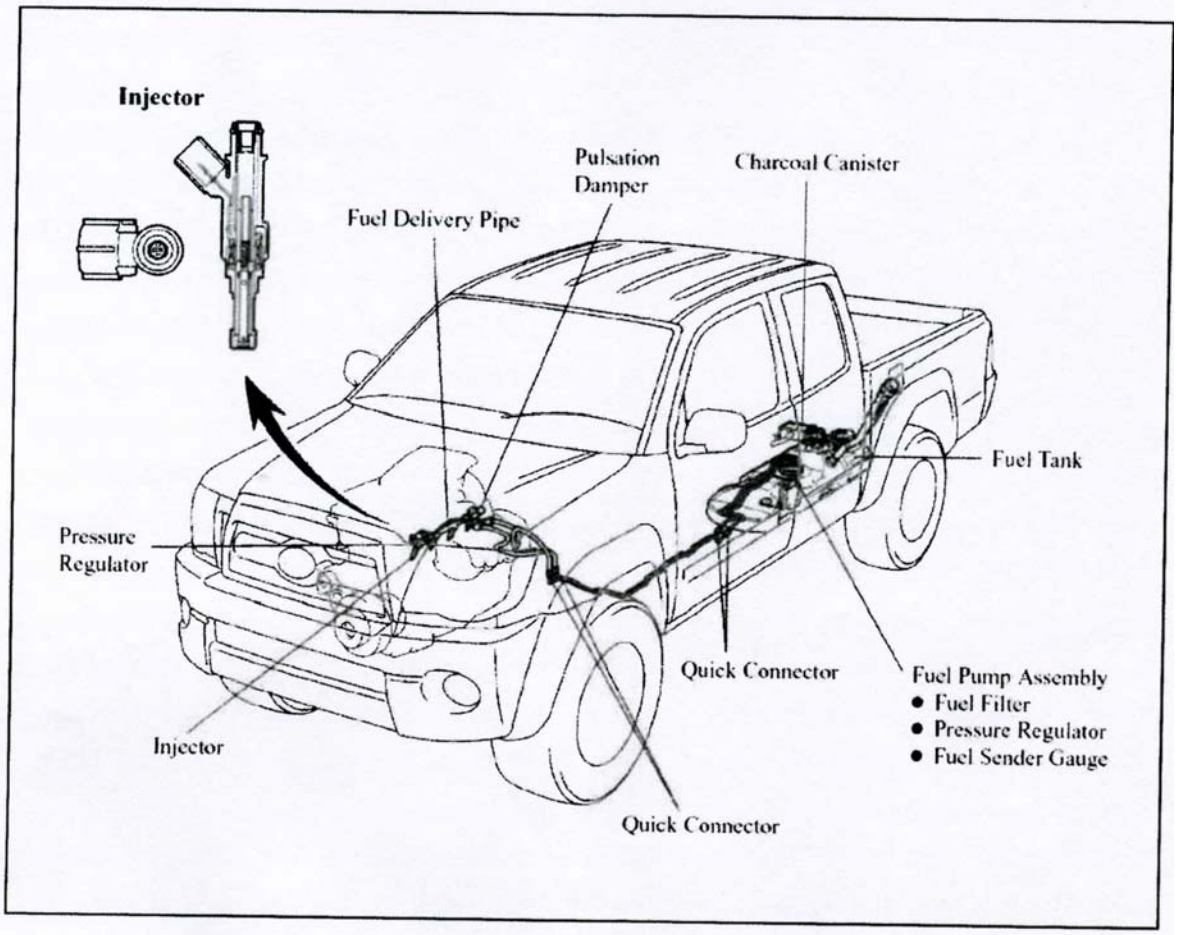


Attachment 4
Page 1 of 2

Fuel system for the 2007MY Tacoma (1GR-FE)

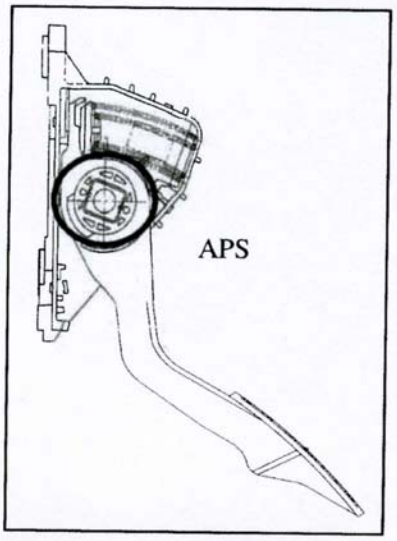


Fuel system for the 2007MY Tacoma (2TR-FE)



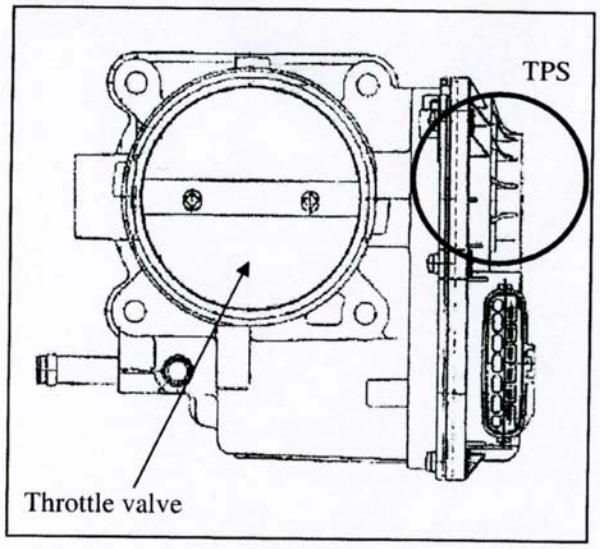
Components of the Accelerator Pedal Position Sensor

(A) Accelerator Pedal Position Sensor (APS)

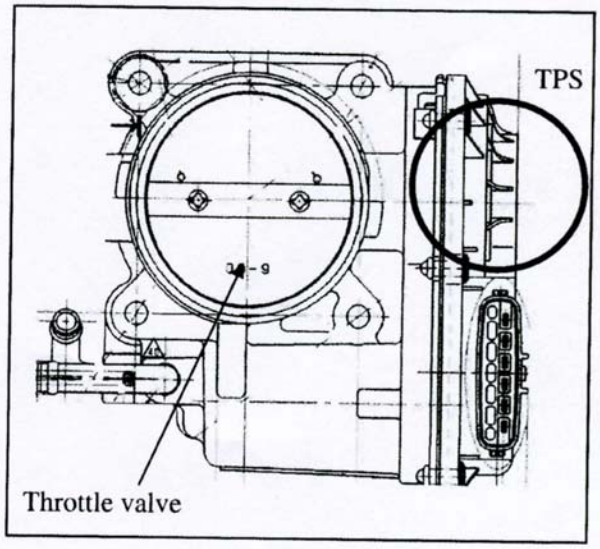


(B) Throttle Position Sensor (TPS)

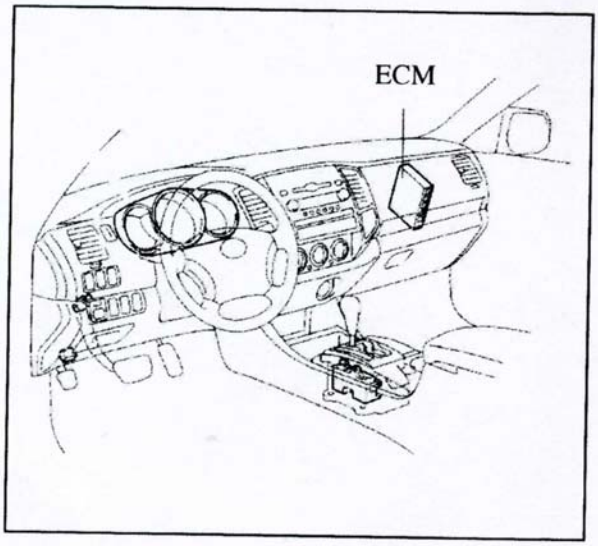
(1GR-FE)



(2TR-FE)

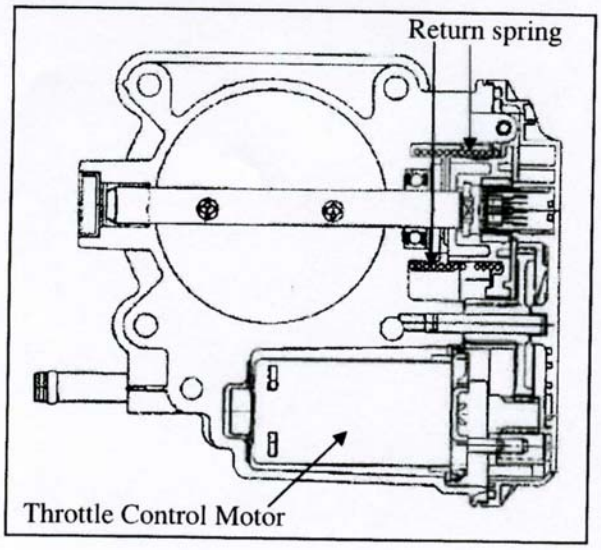


(C) Electronic Control Module (ECM)

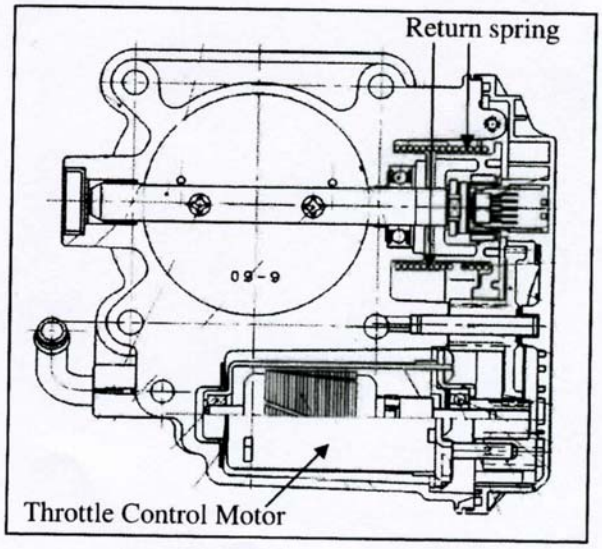


(D) Air throttle plate actuator motor (Throttle Control Motor)

(1GR-FE)



(2TR-FE)



How to measure the opening angle of the throttle valve (1GR-FE)

As for the method of detecting the signal, we are providing the related parts of the repair manual.

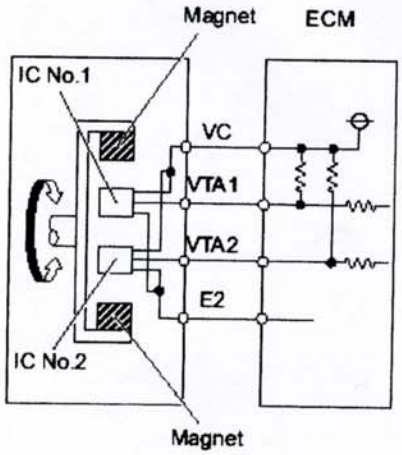
DTC	P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit
DTC	P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input
DTC	P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input
DTC	P0220	Throttle / Pedal Position Sensor / Switch "B" Circuit
DTC	P0222	Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input
DTC	P0223	Throttle / Pedal Position Sensor / Switch "B" Circuit High Input
DTC	P2135	Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation

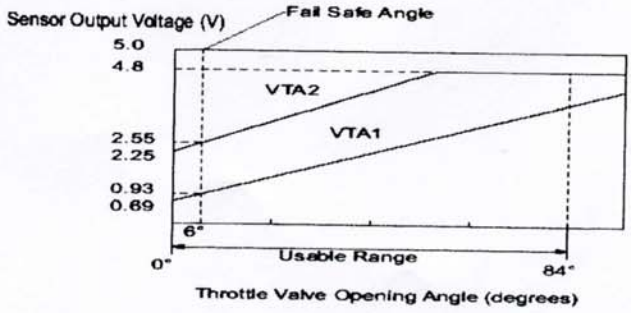
HINT:
These DTCs relate to the Throttle Position (TP) sensor.

DESCRIPTION

This ETCS (Electronic Throttle Control System) does not use a throttle cable. The Throttle Position (TP) sensor is mounted on the throttle body, and detects the opening angle of the throttle valve. This sensor is a non-contact type, and uses Hall-effect elements, in order to yield accurate signals, even in extreme driving conditions, such as at high speeds as well as very low speeds.
The TP sensor has two sensor circuits which each transmits a signal, VTA1 and VTA2. VTA1 is used to detect the throttle valve angle and VTA2 is used to detect malfunctions in VTA1. The sensor signal voltages vary between 0 V and 5 V in proportion to the throttle valve opening angle, and are transmitted to the VTA terminals of the ECM.
As the valve closes, the sensor output voltage decreases and as the valve opens, the sensor output voltage increases. The ECM calculates the throttle valve opening angle according to these signals and controls the throttle actuator in response to driver inputs. These signals are also used in calculations such as air-fuel ratio correction, power increase correction and fuel-cut control.

Throttle Position Sensor





Note:
The throttle valve opening angle detected by the sensor terminal VTA1 is expressed as percentages.
Between 10 % and 24 %: Throttle valve fully closed
Between 66 % and 96 %: Throttle valve fully open
Approximately 19 %: Fail-safe angle (6°)

DTC No.	DTC Detection Conditions	Trouble Areas
P0120	Output voltage of VTA1 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds (1 trip detection logic)	• Throttle Position (TP) sensor (built into throttle body) • ECM
P0122	Output voltage of VTA1 0.2 V or less for 2 seconds (1 trip detection logic)	• TP sensor (built into throttle body) • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	Output voltage of VTA1 4.535 V or more for 2 seconds (1 trip detection logic)	• TP sensor (built into throttle body) • Open in VTA1 circuit • Open in E2 circuit • Short between VC and VTA1 circuits • ECM
P0220	Output voltage of VTA2 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds (1 trip detection logic)	• TP sensor (built into throttle body) • ECM
P0222	Output voltage of VTA2 1.75 V or less for 2 seconds (1 trip detection logic)	• TP sensor (built into throttle body) • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	Output voltage of VTA2 4.8 V or more, and VTA1 between 0.2 V and 2.02 V, for 2 seconds (1 trip detection logic)	• TP sensor (built into throttle body) • Open in VTA2 circuit • Open in E2 circuit • Short between VC and VTA2 circuits • ECM
P2135	Either condition (a) or (b) met (1 trip detection logic) (a) Difference between output voltages of VTA1 and VTA2 0.02 V or less for 0.5 seconds or more (b) Output voltage of VTA1 0.2 V or less, and VTA2 1.75 V or less, for 0.4 seconds or more	• Short between VTA1 and VTA2 circuits • TP sensor (built into throttle body) • ECM

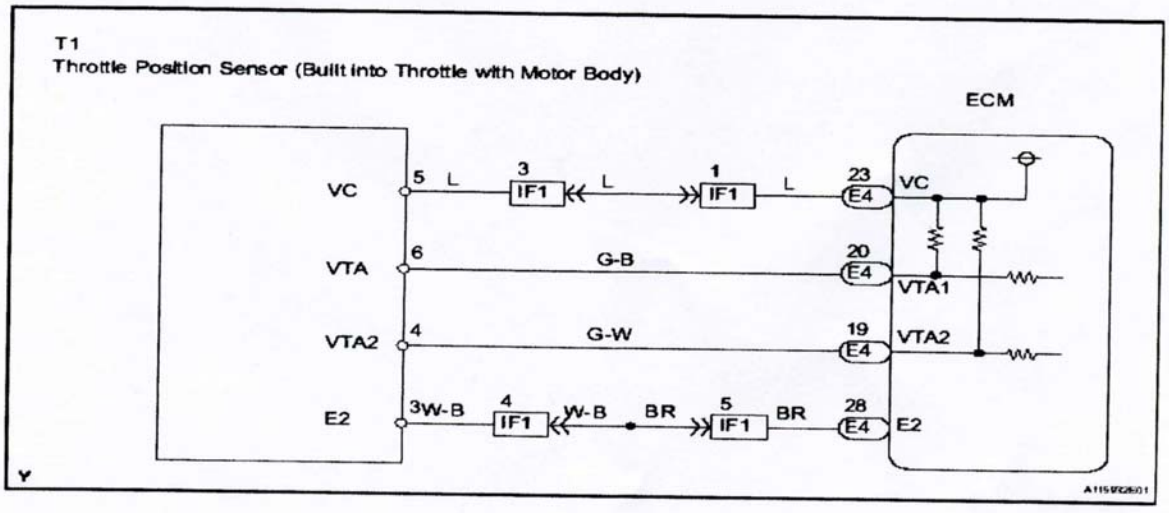
HINT:

- When any of these DTCs are set, check the throttle valve opening angle by selecting the following menu items on an intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / THROTTLE POS AND THROTTLE POS #2.
- THROTTLE POS denotes the VTA1 signal (expressed in percentages), and THROTTLE POS #2 denotes the VTA2 signal (expressed in voltages).

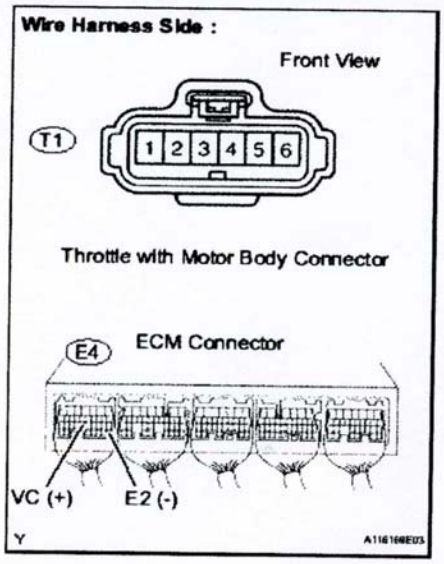
Reference (Normal Condition)

Tester Display	Accelerator Pedal Fully Released	Accelerator Pedal Fully Depressed
THROTTLE POS	10 to 24 %	64 to 96 %
THROTTLE POS #2	2.1 to 3.1 V	4.5 to 5.0 V

WIRING DIAGRAM



3	INSPECT ECM (VC VOLTAGE)



(a) Disconnect the T1 throttle with motor body connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals of the E4 ECM connector.

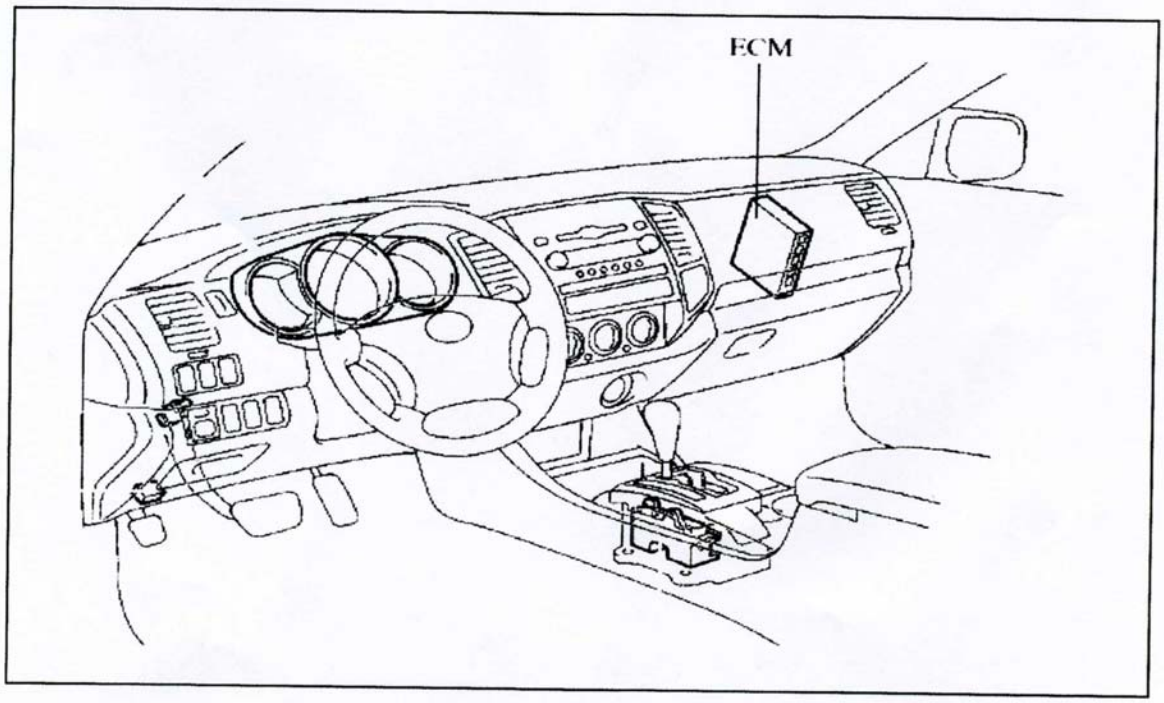
Standard Voltage

Tester Connections	Specified Conditions
VC (E4-23) - E2 (E4-28)	4.5 to 5.0 V

(d) Reconnect the throttle with motor body connector.

NG → REPLACE ECM

Layout of ECM



How to measure the opening angle of the throttle valve (2TR-FE)

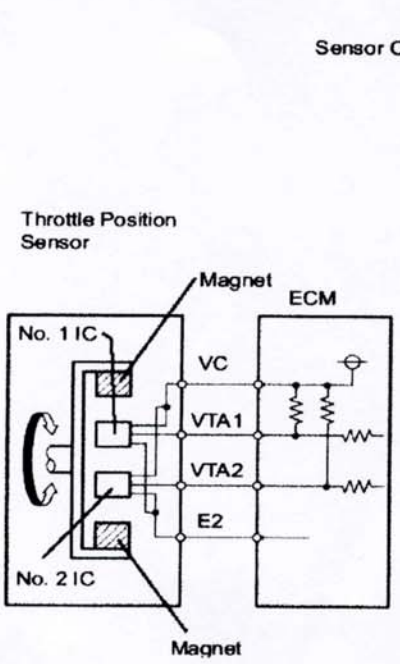
As for the method of detecting the signal, we provide the related parts of the repair manual.

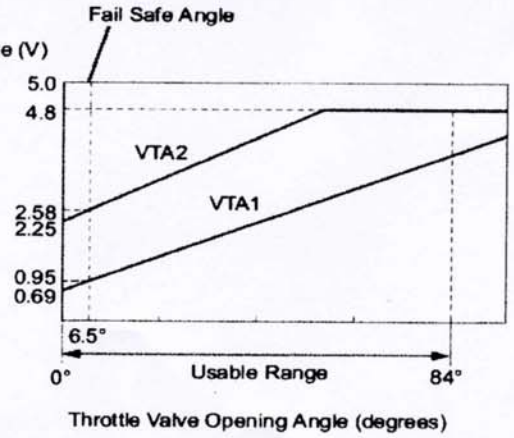
DTC	P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit
DTC	P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input
DTC	P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input
DTC	P0220	Throttle / Pedal Position Sensor / Switch "B" Circuit
DTC	P0222	Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input
DTC	P0223	Throttle / Pedal Position Sensor / Switch "B" Circuit High Input
DTC	P2135	Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation

HINT:
These DTCs relate to the Throttle Position (TP) sensor.

DESCRIPTION

HINT:
The Throttle Position (TP) sensor is mounted on the throttle body, and detects the opening angle of the throttle valve. This sensor is a non-contact type, and uses Hall-effect elements, in order to yield accurate signals, even in extreme driving conditions, such as at high speeds as well as very low speeds. The TP sensor has two sensor circuits which each transmits a signal, VTA1 and VTA2. VTA1 is used to detect the throttle valve angle and VTA2 is used to detect malfunctions in VTA1. The sensor signal voltages vary between 0 V and 5 V in proportion to the throttle valve opening angle, and are transmitted to the VTA terminals of the ECM.
As the valve closes, the sensor output voltage decreases and as the valve opens, the sensor output voltage increases. The ECM calculates the throttle valve opening angle according to these signals and controls the throttle actuator in response to driver inputs. These signals are also used in calculations such as air-fuel ratio correction, power increase correction and fuel-cut control.





Note:

The throttle valve opening angle detected by the sensor terminal VTA1 is expressed as percentages.

Between 10 % and 22 %: Throttle valve fully closed

Between 66 % and 98 %: Throttle valve fully open

Approximately 19 %: Fail-safe angle (6.5°)

DTC No.	DTC Detection Condition	Trouble Area
P0120	Output voltage of VTA1 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds (1 trip detection logic)	• Throttle position (TP) sensor (built into throttle body) • ECM
P0122	Output voltage of VTA1 0.2 V or less for 2 seconds (1 trip detection logic)	• Throttle position (TP) sensor (built into throttle body) • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	Output voltage of VTA1 4.535 V or more for 2 seconds (1 trip detection logic)	• Throttle position (TP) sensor (built into throttle body) • Open in VTA1 circuit • Open in E2 circuit • Short between VC and VTA1 circuit • ECM
P0220	Output voltage of VTA2 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds (1 trip detection logic)	• Throttle position (TP) sensor (built into throttle body) • ECM
P0222	Output voltage of VTA2 1.75 V or less for 2 seconds (1 trip detection logic)	• Throttle position (TP) sensor (built into throttle body) • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	Output voltage of VTA2 4.8 V or more when VTA1 between 0.2 V and 2.02 V (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Open in VTA2 circuit • Open in E2 circuit Short between VC and VTA2 circuit • ECM
P2135	Either condition (a) or (b) met (1 trip detection logic): (a) Difference between output voltages of VTA1 and VTA2 0.02 V or less for 0.5 seconds or more (b) Output voltage of VTA1 0.2 V or less, and VTA2 1.75 V or less, for 0.4 seconds or more	• Short between VTA1 and VTA2 circuit • Throttle position sensor (built into throttle body) • ECM

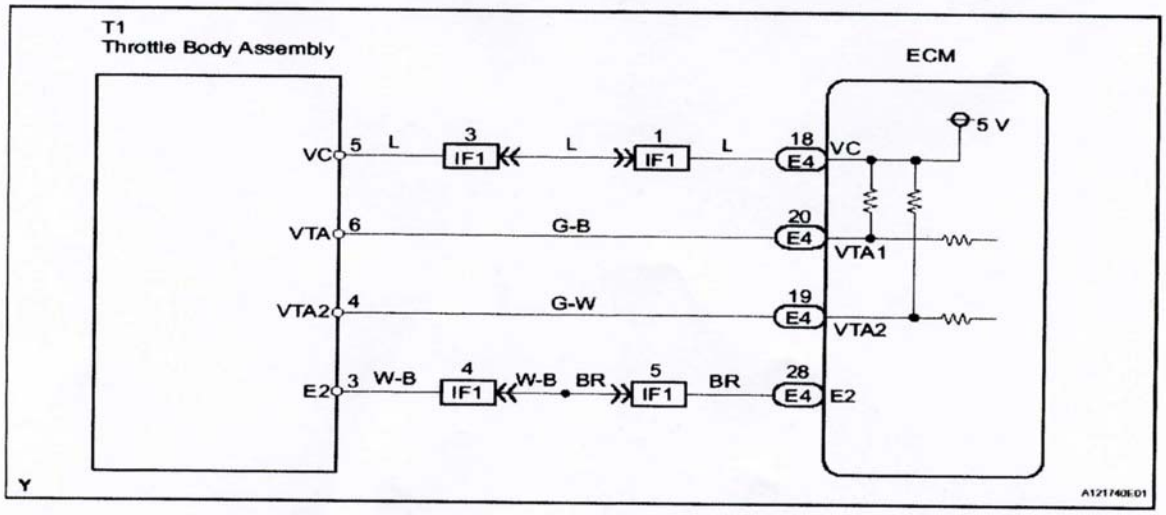
HINT:

- When any of these DTCs are set, check the throttle valve opening angle by selecting the following menu items on an intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / THROTTLE POS AND THROTTLE POS #2.
- THROTTLE POS denotes the VTA1 signal (expressed in percentages), and THROTTLE POS #2 denotes the VTA2 signal (expressed in voltages).

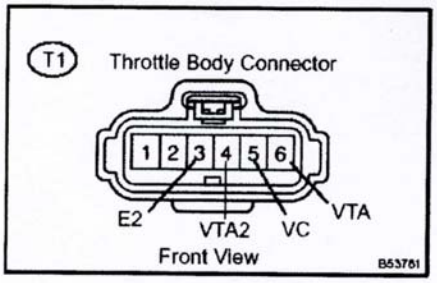
Reference (Normal condition):

Tester Display	Accelerator Pedal Fully Released	Accelerator Pedal Fully Depressed
THROTTLE POS	10 to 22%	66 to 99%
THROTTLE POS #2	2.1 to 3.1 V	4.5 to 5.0 V

WIRING DIAGRAM



3	INSPECT ECM(VC VOLTAGE)

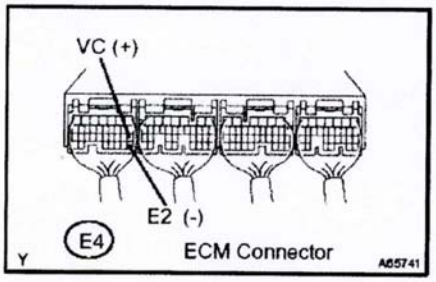


(a) Disconnect the T1 throttle body connector.
(b) Turn the ignition switch to ON.
(c) Measure the voltage between the terminals of the ECM connector.

Standard:

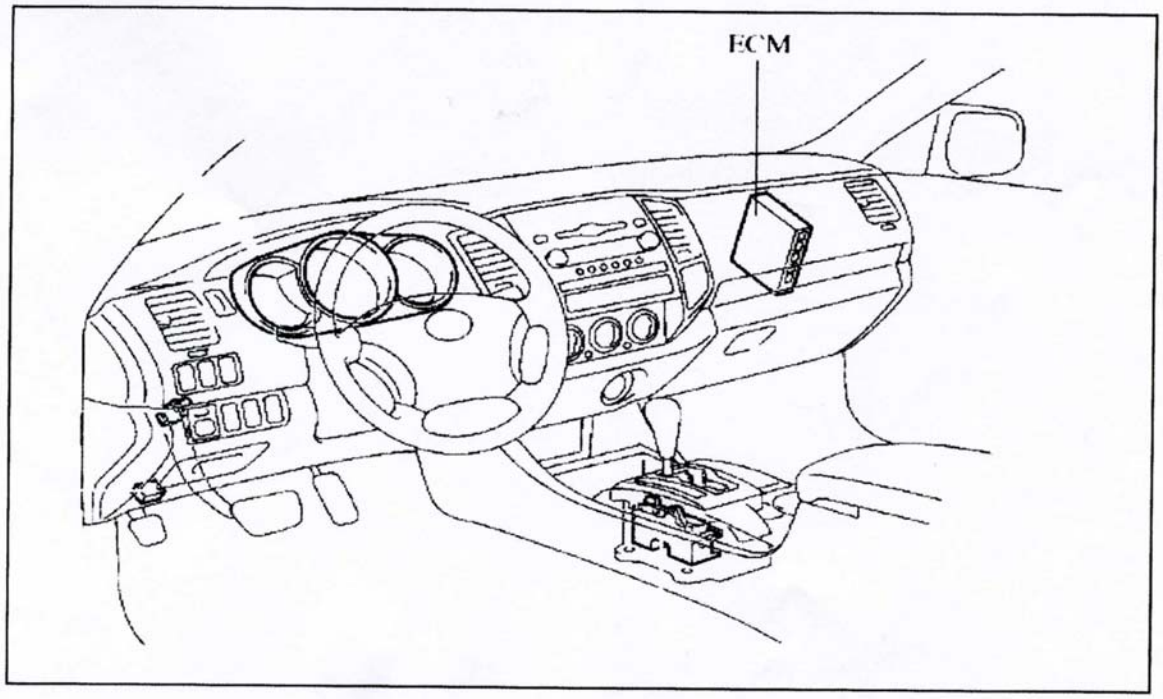
Tester Connections	Specified Conditions
VC (E4-18) - E2 (E4-28)	4.5 to 5.5 V

(d) Reconnect the throttle body connector.



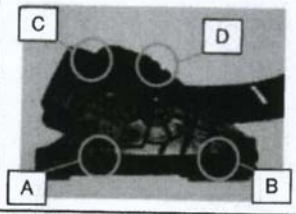
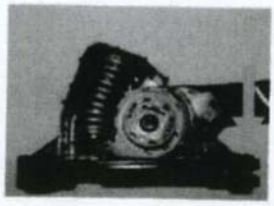
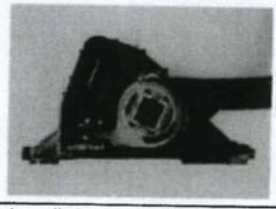
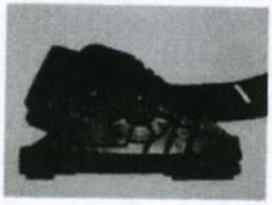
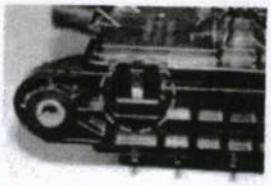
NG → REPLACE ECM (See page 10-24)

Layout of ECM



Attachment 7-1

How to remove Accelerator Pedal Spring

No.	Process
1	Tools 1) Safety glasses 2)Straight slot screwdriver 
2	Using the screwdriver, unfit the snap-fit points A, B, C and D. Detach the sensor cover from the main body.   
3	Push the pedal in the direction represented by the arrow, and then remove the springs and the pedal. During the whole step, care should be taken to not touch the portion denoted by the dashed line.   
4	Reinstall the pedal on the shaft. Reinstall the inner spring (the one with the smaller load) by pushing it in.   
5	Reinstall the sensor cover. Verify that every snap-fit point (A, B, C and D) is firmly fitted. Carry out rewriting of the sensor software.  

Note: The reassembled parts are not included in the performance warranty.

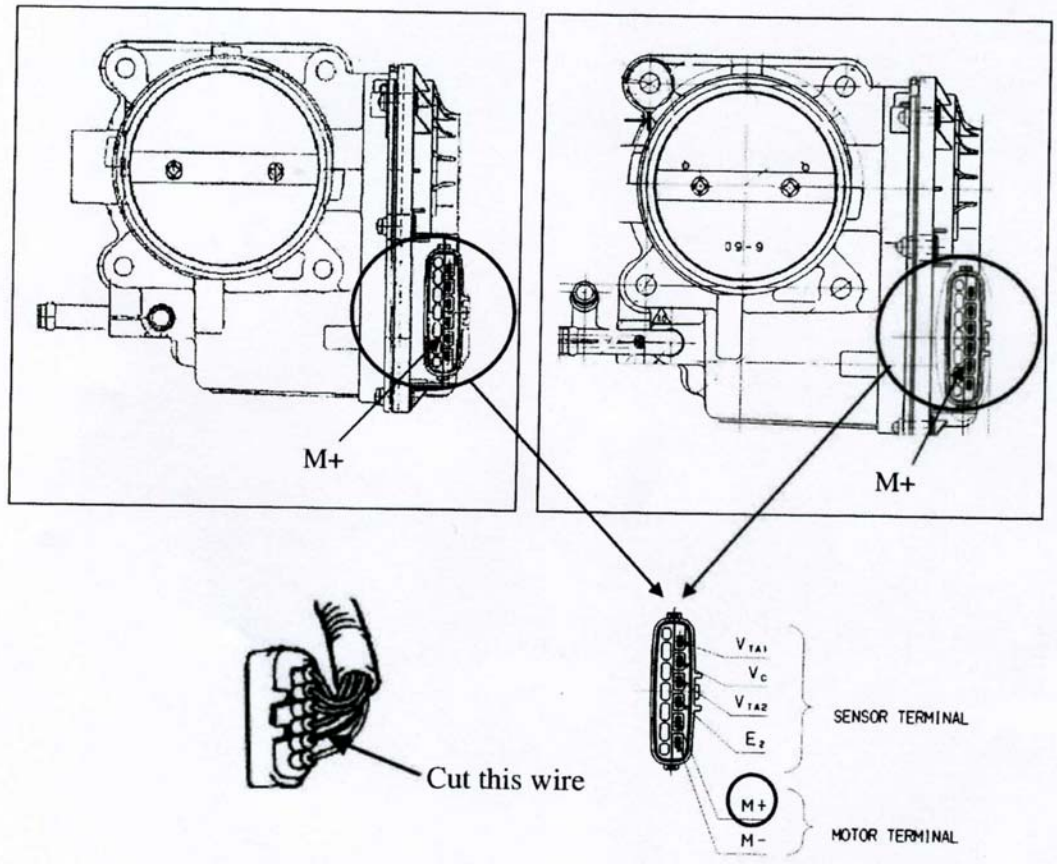
Attachment 7-2

How to remove the energy source of Throttle Body Assembly

Energy source1 (Return spring):
The spring inside the throttle body is not possible to cut or remove.

Energy source2 (Throttle control motor):
Cut the wire to M+ terminal. (See below Figure).

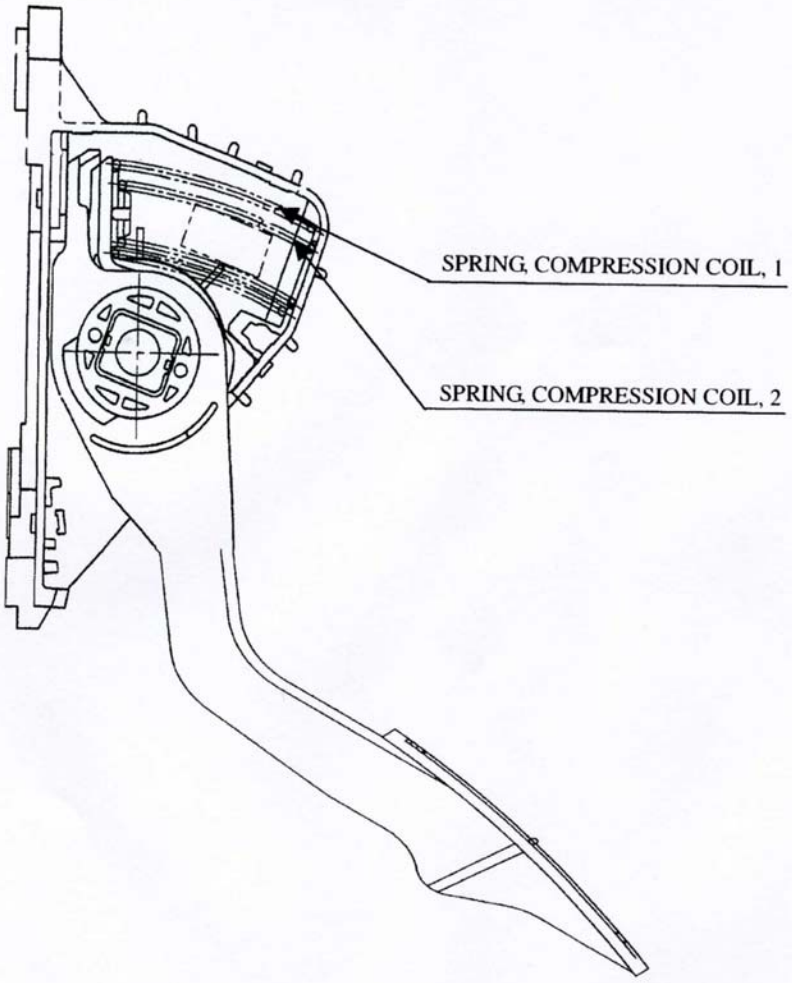
(1GR-FE) (2TR-FE)



Attachment 8-1

Energy source of the Accelerator Pedal Assembly

The Accelerator pedal assembly has 2 sources of energy capable of returning the throttle to the idle position (i.e.; 2 compression coil springs). The details are shown in the figure below.

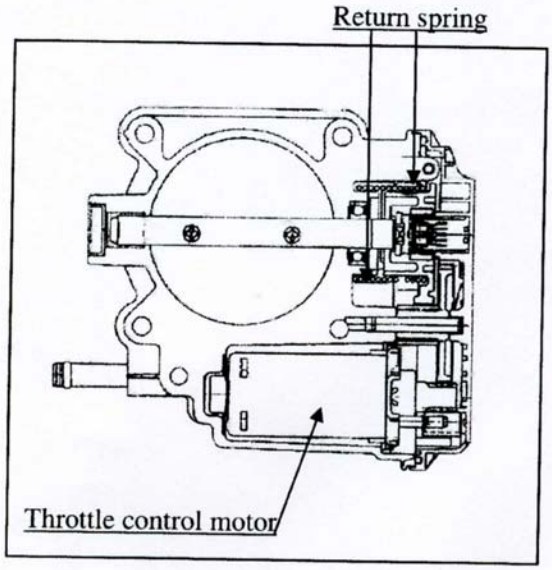


Attachment 8-2

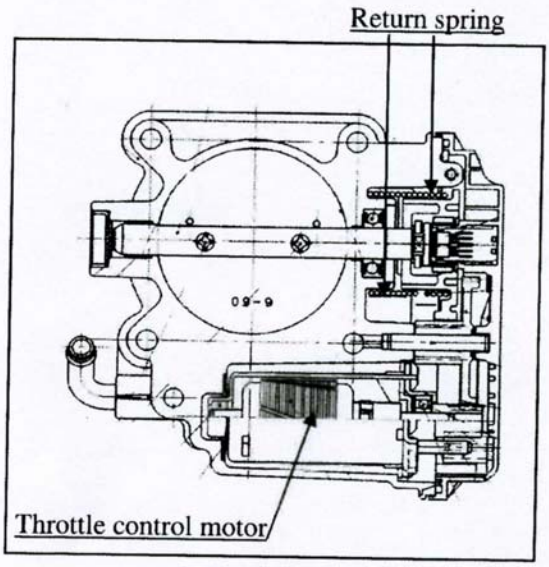
Energy source of the Throttle Body Assembly

The throttle body assembly has 2 sources of energy capable of returning the throttle to the idle position (i.e. The throttle return spring and the throttle control motor). The details are shown in the figure below.

(1GR-FE)



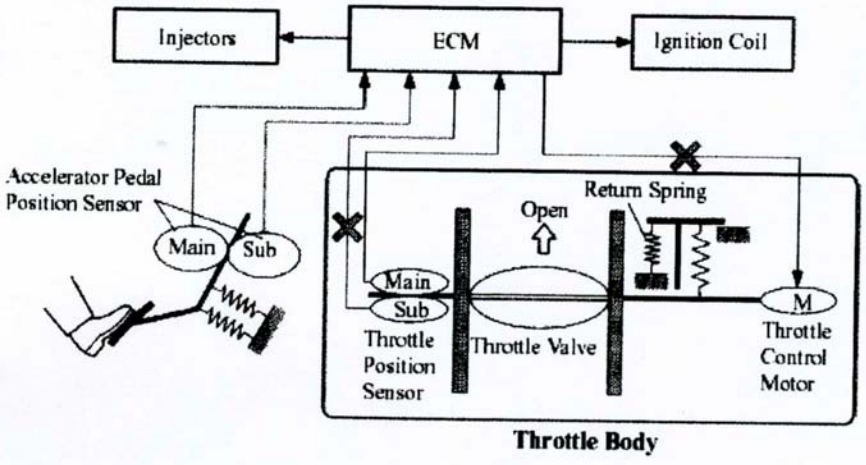
(2TR-FE)



Fail-safe of the Throttle Position Sensor

The throttle position sensor is comprised of two (Main, Sub) sensor circuits.

- If a malfunction occurs in either one of the sensor circuits, the ECM detects the abnormal signal voltage difference between these two sensor circuits, cuts off the current to the throttle control motor, and switches into the limp mode.
- Then, the force of the return spring causes the throttle valve to return and stay at the prescribed opening. At this time, the vehicle can be driven in limp mode while the engine output is regulated through the control of the fuel injection and ignition timing in accordance with the accelerator opening.
- The same control as above is effected if the ECM detects a malfunction in the throttle control motor system.



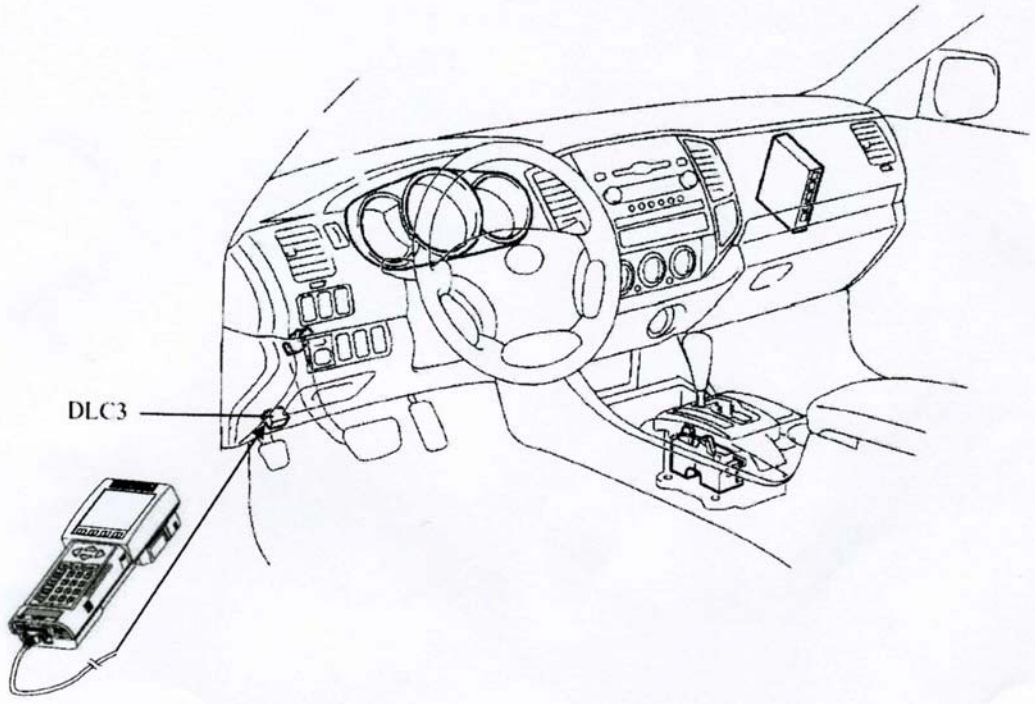
Throttle Body

D13N10

Attachment 10

Instructions Regarding Engine RPM Recording

Equipment: Diagnostic Tester (Part number 0200-2309)
Procedure:
(1) Connect the diagnostic tester to the DLC3 (Date Link Connector 3 (i.e.; ODB II connector)).
(2) Start engine.
(3) Check the engine speed status on the tester screen.



Diagnostic tester