INFORMATION Redacted PURSUANT TO THE FREEDOM OF INFORMATION ACT (FOIA), 5 U.S.C. 552(B)(6)

PE11-005

TOYOTA

4/29/2011

ATTACHMENT 2,

5 PG 4

6 PG 93

7 PG 102

9 PG 106

11 PG 108

13 PG 174

14 PG 176

15 PG 180

16 PG 182

17 PG 242

PE11-005

TOYOTA

4/29/2011

ATTACHMENT 2

Attachment-Response 2

CONFIDENTIAL BUSINESS INFORMATION

Number of subject vehicles Toyota sold an extended service plan

Model	MY	Gold	Platinum	Powertrain	Comprehensive	Total
Highlander Hybrid	2006	CONFIDENTIAL BUSINESS INFORMATION				
Total						

PE11-005

TOYOTA

4/29/2011

ATTACHMENT 5, Arbitration

Case #: **5006118** VIN: **JTEDW21A460**[redacted] Start Date: **03/21/2006**

Model Year: **2006** Model: **Highlander** Purchase Date:

Dealer#: **09094 - SUN TOYOTA** Current Mileage: **90**

CUSTOMER INFORMATION

First Name: [redacted] Last Name: [redacted]

[redacted]

Weeki Wachee **FL** [redacted]

Day Phone: [redacted]

Evening Phone:

Case Status History:
Login: **03/21/2006**
Process Selection: **04/03/2006**
Case Assigned: **04/10/2006**
Meeting Scheduled: **04/14/2006**
Closed: **04/28/2006**

CASE INFORMATION

STATUS: **CASE CLOSED** Status Date: **04/28/2006**

Eligible: **Y** Remedy Sought: **Other** Case last updated: **11/08/2006**

Process: **D**

HEARING INFORMATION

Hearing Date: **04/25/2006** Hearing Time: Hearing Location: **NCDS**

RESOLUTION INFORMATION

Resolution: **Board** Decision: **No Action** Close Date: **04/28/2006**

Customer's Acceptance: **No** Customer Accepted Date: **05/05/2006** Compliance Date:

Days Case was Open: 39

Case Notes: (Optional)

DR On-Line case has been created for this NCDS Case: 03/22/2006 - Maureen Kinnear

Region/PD: **Southeast Toyota** Created by:Maureen Kinnear on 03/22/2006 (Days Open:42)

Region Contact: Craig Elias **Status:** Closed

Responsible Source: TMS Note:

Case Closed by : Maureen Kinnear on 05/01/2006

Customer **First** Name: [redacted] **Last** Name: [redacted] State: FL

VIN: **JTEDW21A460**[redacted] Customer Connection Case Numbers: **200603100909**

✓ Populate Vehicle Info

Year of Vehicle: **2006** Model: **Highlander Hybrid** Model Code:**6960**

Vehicle Description: **2WD 5-Door Hybrid (V6) SUV with a CVT-E transmission**

Built Date: **11/24/2005** DOFU:**02/14/2006** Veh. Color: **Gold**

Is Vehicle: ● Leased ○ Purchased

Mileage-Current:**90**

Dominant Servicing Dealer: **SUN TOYOTA** Dlr Code: **09094** dst: **2**

☐ Filed State Arbitration ☒ Filed NCDS/CDSP Arbitration ☐ Voluntary ☐ Lawyer

Case#: **5006118**

Condition Category:	Condition:
1- Engine	**Engine Stalling**

What Resolution is the customer seeking? (check all that apply)

☐ Repurchase ☒ Reimbursement ☐ Other

☒ Replacement ☐ Repair ☐ Unknown

Type of Case:	NCDS	Decision:	No Action
Outcome of Case:	Arbitrator Denied Claim		
Case Finalized:	04/28/2006		

Case Notes for: [redacted]

Completed MRF was sent to NCDS (David Carpenter@NCDS@Toyota)
CCs to: PGreen, chan, Maureen Kinnear, Amy Parks, Jim Watson
Craig Elias -- 3/27/2006 11:16:27 AM

The built date has been added.
Garett P Burnham -- 03/29/2006 09:47:36 AM

Case closed in DR On-Line on 05/01/2006
Maureen Kinnear -- 05/01/2006 08:58:59 AM

Misc. Attachments

Parente-POF2.TIF Parente-POF.TIF

[redacted]

NCDS Case Information

Southeast Toyota
Florida

NCDS Case #: 5006118

Start Date: 03/21/2006

Date Customer Claim Form Received: 03/21/2006

Date of NCDS Technical Inspection:

Hearing Information

Date: 04/25/2006 Time:

Location: NCDS

Participate by: ○ By Mail ○ By Phone ● In Person

Toyota Rep: Jim Watson

Arb. List NCDS Arbitrator: NCDS

Attach Customer Claim Form:

[redacted]NC.tif

Was case closed/resolved prior to arbitration? ○ Yes ● No Was case closed due to legal involvement? ○ Yes ○ No

Decision Date: 04/25/2006

Mileage at Hearing:

Decision: ○ Repurchase ○ Replacement ○ Repair ○ Reimbursement ○ Other ● No Action

Date Decision Received: 04/28/2006

Days to Comply:

Did customer: ○ Accept ● Reject

Date Cust's Signed Rejection Received: 05/04/2006

Compliance date:

Attach NCDS Decision Here: Attach Cost Documents Here: Attach Acceptance Here:

[redacted]-RDC.TIF [redacted]DC.TIF

Parente-RDC.tif

[redacted]AC.TIF

Request for Technical Correction (RTC) and Post Decision Settlement Area

This section is viewable by Regions/PDs, but is only "editable" by TMS

REQUEST(S) FOR TECHNICAL CORRECTION

Date RTC Submitted: Rationale: (Please select the Rationale)

Was Decision Revised? ○ Yes ○ No

Did Customer: ○ Accept ○ Reject

New Compliance date:

Attach RTC Here: Attach Arbitrator Response: Attach Customer Acceptance:

Create a Post Decision Settlement? ☐ Yes

National Center for Dispute Settlement
2777 Stemmons Freeway • Suite 1452
Dallas, Texas 75207
(214) 638-2700
Fax: (214) 638-4054

March 21, 2006

[redacted]
Weeki Wachee, FL[redacted]

RE: CASE # 5006118

Dear [redacted]

Your request for arbitration has been received. The claim appears to meet the Toyota Dispute Settlement Program parameters for eligibility and has been assigned the case number shown above. This process is regulated by the Federal Trade Commission (FTC) under the Magnuson-Moss Warrant Act, which provides for the expedient resolution of Customer complaints. Therefore, under federal law, the National Center for Dispute Settlement, (NCDS) is required to close your case within forty (40) days of this letter.

You have the option of having an oral hearing or a "document only" process. If you choose to make an oral presentation and do not appear at the scheduled hearing, Toyota will still be entitled to make their presentation. If you do not want to make an oral presentation, your dispute will be decided on the basis of documents submitted by all parties. You do not need to be present at a "document only" decision process. You will receive a call from NCDS to determine which process you have selected.

You may be contacted by NCDS prior to the hearing date in an effort to help you and Toyota reach voluntary agreements to resolve the dispute. If you agree to a mediated settlement, the terms of the agreement will be put in writing and you will be asked to sign the settlement agreement. The case will then be closed.

If you do not agree to any settlement offer, the dispute will be decided at your scheduled oral hearing or document review. You will receive a written decision by the Arbitrator(s) within ten (10) days after the oral hearing or document review. You may either accept or reject the decision. If you accept the decision, Toyota will comply with the decision within the time stipulated. If you reject the decision, the case will be closed and you may pursue any other legal remedies available to you.

If you have not done so already, please provide us with copies of all relevant service tickets, as well as a copy of your title, current registration and bill of sale or lease contract. Your participation in the Dispute Settlement Program does not relieve a vehicle owner of any obligation to a lender or leasing agent.

NCDS will be responsible for monitoring the progress of this case and will be happy to answer any questions you may have about the arbitration process. You may call NCDS, toll free at 888-300-NCDS (6237).

Sincerely,

C. Han

Chin Han
Case Administrator

cc: Southeast Toyota Distributors, LLC

National Center for Dispute Settlement
2777 Stemmons Freeway • Suite 1452
Dallas, Texas 75207
(214) 638-2700
Fax: (214) 638-4054

March 21, 2006

Toyota Motor Sales, U.S.A., Inc.
Southeast Toyota Distributors, Llc
201 Nw 12Th Avenue
Deerfield Beach, FL 33442

RE: CASE # 5006118

Dear Manufacturer:

Please complete a Manufacturer's Response Form and forward a copy to the National Center for Dispute Settlement within ten (10) days from the date on this letter in order for it to be considered during the decision making process.

It is essential to the decision making process that all available information concerning each case be provided to the decision maker.

As with any hearing, lack of participation by a concerned party deprives the process of information on which a reasoned decision can be made.

Thank you for your participation in the process.

Sincerely,

C. Han Rw

Chin Han
Case Administrator

cc: [redacted]

FOR NCDS USE

Customer Claim Form

CASE NUMBER: 500618

CUSTOMER NAME AND ADDRESS

☑ Mr. ☐ Mrs. ☐ Ms. First name [redacted] MI Last name [redacted]

Street address [redacted]

City WEEKI WACHEE State FL Zip code [redacted]

Day phone [redacted] Evening phone [redacted] Fax [redacted]

VEHICLE INFORMATION

Name(s) that appears on the vehicle title: [redacted]

Is vehicle used for business? NO How often is the vehicle used for business purposes (percentage) N/A % How many other vehicles are owned or leased by the business? N/A

Make: TOYOTA Model: HIGHLANDER HYBRID Year: 2006 Current mileage: 90

Vehicle Identification Number JTEDW21A460[redacted]

Selling dealer and address: SUN TOYOTA 4203 U.S. HIGHWAY 19, NEW PORT RICHEY, FL. 3465

Dominant Servicing Dealer: SUN TOYOTA

If vehicle was purchased, complete the following	*If vehicle was leased, complete the following*
Purchase date: Mileage at purchase:	Lease date: 2-14-06 Mileage at lease: 18
Purchased as (check): ☐ new ☐ used ☐ demo ☐ fleet	Leased as (check): ☑ new ☐ demo ☐ fleet
Are your loan payments current? ☐ YES ☐ NO	Are your lease payments current? ☑ YES ☐ NO
Is the vehicle in your possession? ☐ YES ☐ NO	Is the vehicle in your possession? ☐ YES ☑ NO
Lienholder's name & address:	Leasing company's name & address: SETF - P.O. B 7083 - CHARLOTTE NC. 28241
Account number:	Account number: [redacted]
Lienholder's phone number: ( )	Leasing company's phone number: (800) 686-3454

VEHICLE PROBLEM(S)

Problem	List dealer(s) which have repaired or attempted repair (include city and state).	List the date, mileage, and repair order number for each repair attempt.	Does the problem currently exist? (Circle)
Example: A/C won't cool properly	Autoworld, Inc. Anytown, VA	4/23/92 3,500 miles #873540	(yes) no
"SEE ATTACHED"			yes no
		RECEIVED	yes no
		MAR 21 2006	yes no
			yes no
		N.C.D.S.	yes no

Has the vehicle been involved in an accident? ☐ YES ☑ NO

If YES, give date of accident: _____ Specify damaged area: _____

Resolution Sought:

NEW AUTOMOBILE + REIMBURSEMENT OF LEASE PAYMENTS VS. THE CAMRY

[redacted]

3/14/06
DATE

Return all copies of this form to:

National Center for Dispute Settlement
P.O. Box 561109
Dallas, TX 75356-1109

06-ORE-019

STATEMENT- 3/14/06

On 3/6/06, my 2006 Toyota Highlander Hybrid with 900 miles broke down in traffic. Toyota roadside assistance towed the car to Sun Toyota in New Port Richey, Florida were I originally leased it. At that time, I was given a Hyundai Sonata rental car.

On 3/7/06, called Skip Kolbe, Sun's Asst Service Manager who advised me they were working on the problem and that they called the Toyota Hotline two times and was still awaiting help from them.

On 3/8/06, Bob Sturgeon Sun's Service Director called and stated they were unable to determine the problem but have now sent all the information to California who in turn will be speaking to Japan. I complained about the rental car as I should have received an SUV since I was leasing an SUV and have made two payments. He informed me he would call the rental Company to take care of the situation. Received a call from Hertz who advised I would have to go their satellite office to pick-up a Toyota Camry as they were unable to deliver it. A far cry from an SUV.

On 3/9/06 Alan Fielding from Sun Toyota called and stated the technicians still do not know the problem and believed I should get a new car. Spoke to Mr. Steven Kane and advised him I have lost confidence in this car and wanted a new one. He said they have not had any problems with the Hybrid but understood my concerns. I told him I was going to New York in April and was very apprehensive about getting stuck again with an ailing wife. He said they were looking into it and someone would get back to me by 3/14/06 Noon time.

On 3/10/06 Lori Sun's Customer Relations Manager called and said I must call California to get a case so they can proceed about a new car. Called and received case No. 200603100909 and they were sending me arbitration papers. Called Lori and left a message asking why I needed arbitration.

On 3/13/06 Bob Sturgeon called me and advised a part was ordered and once received could not be installed until Japan gave him the okay.

On 3/14/06 Lori Sun's Customer Relations Manager called me and said she now couldn't speak to me as it was in arbitration.

As of today, No one can tell me the problem, how long it is going to be since it is now in arbitration.

[redacted]

RECEIVED
MAR 21 2006
N.C.D.S.

RECEIVED
MAR 21 2006
N.C.D.S.

REG. TAX	INT REG.	COUNTY FEE	DMV FEE	SALES TAX	TITLE FEE
$14.43	$	$2.50	$	$0.00	$

PLATE ISSUED	DATE ISSUED	INTERNET KIOSK FEE	VOLUNTARY CONT. TOTAL	GRAND TOTAL
	03/03/06	$0.00	$	$16.93

FLORIDA VEHICLE REGISTRATION

DATE ISSUED: 03/03/06
DL#: P653638410030
TAG#: LVI556 DECAL#: 00225175 EXP: 01/03/07
VIN: JTEDW21A460[redacted] TC: 95308201 YR/MK: 2006 TOYT

[redacted]
BROOKSVILLE, FL [redacted]

I #: 997995 T#: 450183294 R#: 707431 R#: 450183294

RECEIVED
MAR 21 2006
N.C.D.S.

STATE OF FLORIDA
APPLICATION FOR VEHICLE/VESSEL
CERTIFICATE OF TITLE
AND/OR REGISTRATION

COUNTY	AGY #	SUB #	REPORT #
38	2	20	1842

L# [redacted]

T# 450183101
E# 707431
R#

DECAL NUMBER	DECAL YR. ISSUED	BIRTHDATE SEX	MO.	DAY	YEAR	EXPIRES MO.	DAY	YEAR	TRANS CODE	INSURANCE PIP	LIABILITY	PLATE ISSUED	RESIDENT Y	N	ALIEN	FLORIDA R.I.S. #	DATE OF ISSUE MO.	DAY	YEAR	PLATE NUMBER OR FLORIDA #
	0								ORT						X		03	03	06	

TITLE NUMBER	VEHICLE / VESSEL IDENTIFICATION #	YR.	MAKE	MAKE o. MANUFACTURER	BODY TYPE	CLASS	WT / LENGTH	GVW / LOC
95308281	JTEDV21A460[redacted]	2006	TOYT		UT	0	3964	

HULL MATERIAL	PROPULSION	I.E.	VESSEL USE	VESSEL TYPE	WATER	NEW USED	VEHICLE COLOR	1st OWNER FL / DL# OR F.E.I.D.#
							GLD	-

Applicant / Owner's Name & Address

VT INC TSTEE (BLT
PO BOX 91326
MOBILE, AL 36691

2nd OWNER FL / DL# OR UNIT #

VOLUNTARY CONTRIBUTIONS:

FLEET NUMBER	CREDIT VEHICLE MOS.	CLASS	WT/LENGTH	MOS.	REG. FEE	INT. REG.	AGENCY FEE	MAIL FEE	TITLE FEE	SALES TAX	GRAND TOTAL
							4.25	0.00	8.00	0.00	12.25

Action Requested: ORIG NEW TITLE

Brand:

STATE PREV. REG.	DATE ACQUIRED	NEW	USED	ODOMETER / VESSEL MANUFACTURER
	02/14/2006	XX		18 MILES 02/14/2006 ACTUAL

LIEN INFORMATION

DATE OF LIEN: 02/14/2006

FEID # OR FL / DL # AND SEX AND DATE OF BIRTH: -

☐ ODOMETER DECLARATION CERTIFICATION

NAME OF FIRST LIENHOLDER (LAST ON, IF NO 2ND):
AL HOLDING CORP

ADDRESS:
PO BOX 91326

VEHICLE USE:
PRIVATE

CITY: MOBILE STATE: AL ZIP CODE: 3669[illegible]

SALVAGE TYPE:

SELLER INFORMATION

NAME OF SELLER, FLORIDA DEALER, OR OTHER PREVIOUS OWNER:
SUN AUTOMOTIVE INC

ADDRESS:
4023 US HWY 19

CITY: NEW PT RICHEY STATE: FL ZIP CODE: 34652

DEALER LIC. ENSE NO.:
VF10020321

RECEIVED
MAR 21 2006
N.C.D.S.

SALES TAX AND USE REPORT

TRANSFER OF TITLE IS EXEMPT FROM FLORIDA SALES OR USE TAX FOR THE REASON(S) CHECKED

☐ PURCHASER HOLDS VALID EXEMPTION CERTIFICATE

☒ VEHICLE/VESSEL WILL BE USED EXCLUSIVELY FOR RENTAL

CONSUMER OR SALES TAX EXEMPTION #

INDICATE TOTAL PURCHASE PRICE, INCLUDING ANY UNPAID BALANCE DUE SPECIAL EQUIPMENT OR OTHERS $ _____

INDICATE SALES OR USE TAX DUE AS PROVIDED BY CHAPTER 212, FLORIDA STATUTES $ 0.00

☐ OTHER _____

☐ SELLING PRICE VERIFIED

APPLICANT CERTIFICATION

☐ I/WE HEREBY CERTIFY THAT THE VEHICLE/VESSEL TO BE TITLED WILL NOT BE OPERATED UPON THE PUBLIC HIGHWAYS/WATERWAYS OF THIS STATE.

☐ I CERTIFY THAT THE CERTIFICATE OF TITLE IS LOST OR DESTROYED.

☐ I CERTIFY THAT THIS MOTOR VEHICLE/VESSEL WAS REPOSSESSED UPON DEFAULT OF THE LIEN INSTRUMENT AND IS NOW IN MY POSSESSION.

I/WE HEREBY CERTIFY THAT I/WE LAWFULLY OWN THE ABOVE DESCRIBED VEHICLE/VESSEL, AND MAKE APPLICATION FOR TITLE. IF LIEN IS BEING RECORDED, NOTICE IS HEREBY GIVEN THAT THERE IS AN EXISTING WRITTEN LIEN INSTRUMENT INVOLVING THE VEHICLE/VESSEL DESCRIBED ABOVE AND HELD BY LIENHOLDER SHOWN ABOVE. I/WE FURTHER AGREE TO DEFEND THE TITLE AGAINST ALL CLAIMS.

UNDER PENALTIES OF PERJURY, I DECLARE THAT I HAVE READ THE FOREGOING DOCUMENT AND THAT THE FACTS STATED IN IT ARE TRUE.

Signature of Applicant/Owner

Signature of Applicant/Co-Owner

HSMV 82041 (REV. 07/05) S

OWNER COPY

National Center for Dispute Settlement
2777 Stemmons Freeway • Suite 1452
Dallas, Texas 75207
(214) 638-2700
Fax: (214) 638-4054

May 1, 2006

[redacted]
Weeki Wachee, FL [redacted]

Toyota Motor Sales, U.S.A., Inc.
Southeast Toyota Distributors, LLC.
201 NW 12th Avenue
Deerfield Beach, FL 33442

RE CASE: # 5006118

Dear [redacted]

We have made an administrative error during the processing of the decision from the Board Members. Specifically, there was a key word left out of the decision page. Please find enclosed the corrected decision page.

We are sorry for any inconvenience this may cause.

Sincerely,

Chin T. Han
Case Administrator

cc: Board Members

DECISION:

After reviewing the complaint(s) and hearing the proofs and arguments of the parties and taking into consideration the applicable manufacturer's new vehicle warranty, and the applicable warranty law including the applicable State Statute commonly referred to as the "Lemon Law," and after due deliberation, we find and Award as follows:

The Customer's request for a replacement vehicle and reimbursement of least payments versus the Toyota Camry is hereby DENIED.

We have reached this conclusion because there were not an unreasonable number of repair attempts that did not substantially impair the use, value or safety of the vehicle.

TOYOTA MOTOR SALES, U.S.A., INC.

Manufacturer Response Form

Customer Name: [redacted]	Case #: **5006118**
VIN: **JTEDW21A460[redacted] (2006 Highlander Hybrid)**	Start Date: **03/21/2006**

Manufacturer Information

Region: **Southeast Toyota**	Servicing Dealer: **SUN TOYOTA**
Can the hearing be held at the servicing dealership? ● **Yes** ○ **No**	

Manufacturer's Statement

Are the customer's concerns covered under Toyota's Warranty? If no, please explain:
Yes, the customer's stalling concerns have been covered under Toyota's New Vehicle Limited Warranty.

Is the customer's vehicle currently unrepaired? Does the concern exist? Explain:
No. The customer's vehicle is not unrepaired. The vehicle had a new transmission and a new electrical inverter installed. According to Toyota engineers, Toyota's Technical Center, and the Sun Toyota service department, the vehicle is now operating as designed.

Is the use, value or safety of this vehicle substantially impaired? Explain:
No, the use, value, or safety is not substantially impaired. The customer is currently driving the vehicle.

Are the number of repair attempts or number of days down accurate? Explain:
Yes. The customer did not complete the section on his claim form, but attached a timeline which appears to be accurate.

Please provide your position in regard to the customer's claim(s).
The vehicle had a new transmission and a new electrical inverter installed. According to Toyota engineers, Toyota's Technical Center, and the Sun Toyota service department, the vehicle is now operating as designed. Should this case be heard by the NCDS Board Panel, Toyota requests an independent inspection in order to verify that the customer's concern(s) exists.

R/PD will participate ○ **By phone** ● **In Person** ○ **In Writing**	Available Dates:**TBD**
Return this form by: **03/30/2006**	Toyota Contact: **Craig Elias**
NCDS: (586) 790-4774	Phone: **(954) 420-4741** Fax: **(954) 363-4122**

NOTE: Do not send this page to Customer or to Arbitrator

Customer Name: [redacted]	Case #: 5006118

Settlement Efforts

List any previous settlement offers made to the customer: **None.**
R/PD willing to mediate a settlement? ○ Yes ● No
List any settlement offers you would like communicated to the customer: **None.**

[redacted]

NCDS CASE CLOSURE

Southeast Toyota
Florida

What was the final outcome of this case?

- ○ TMS Complied with Decision
- ○ TMS Mediated Case
- ○ Case Closed Due to Ineligibility
- ○ Customer Rejected Decision
- ○ Customer Withdrew Claim
- ○ Customer Withdrew Claim-R/PD Settlement
- ● Arbitrator Denied Claim
- ○ Other
- ○ Claim resulted in Legal Case

Date NCDS closed case: **04/28/2006**

Year/Model of replacement vehicle:

VIN of Replacement Vehicle:

Remove customer from future marketing mailings: ● Yes ○ No

Attachment(s)

PE11-005

TOYOTA

4/29/2011

ATTACHMENT 5, Field Report

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-VGU224451	TMS	QA-Hybrid	FPE	TMS-SF	27123-1	9/19/2005

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander	2006	22-Jun-2005	726 mi	JTEDW21A960[redacted]

Condition Title

MIL ON, DTC POA7A "Generator Inverter Performance"

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
29-AUG-2005		

Condition Description

MIL had illuminated, setting DTC P0A7A – Sub code 325 ("Generator Inverter Performance") in ECU memory. Malfunction occurred (25) days after Customer took delivery of vehicle on 07/31/05.

- Condition occurred while customer was driving at low speed in parking lot.
- Master Warning, MIL, and VSC Indicator Lights had illuminated. Multi Information Display also indicated "Check Hybrid System".
- Vehicle performance appeared normal.

Unit was a 2006 Highlander Limited 4x2 model, equipped with GPS Navigation, JBL Audio, Running Boards, Tow Package, and Gold Kit options.

Diagnostic Steps:

Technician examined Vehicle, determined that DTC P0A7A was set in ECU memory, and conducted a road test. Technician then contacted TMS QAP HV to report condition. TMS QAP HV Contacted FPE SF to request for possible Go & See at affected Dealer. Technician was asked to generate a TechView File that included data recorded from Vehicles HV ECM. TechView File was transmitted to TMS QAP HV via E-Mail

- FPE SF conducted a Go and See Dealer contact with a TMS/CQEC Survey Team on 08/29/05 at Fremont Toyota (Dealer Code 04338).
- Vehicles Hybrid Inverter system was tested using TMC Scan Tool and data was recorded.
- High Voltage Wire Harness insulation was tested using a Megohmmeter, and readings were normal. Wire harness was also tested with an Ohmmeter for short/ground circuits, and again readings were normal.
- Low Voltage Wire Harness between Inverter and Hybrid Control ECU was tested using a DVOM and all tests indicated normal condition.

Circuit between MG ECU and Resolver was tested using a DVOM and all results were with in specification. Note however, test procedure outlined on page HV-394 in 2006 Highlander HV Repair Manual was missing an important step in process.

- Step 6 entitled "Check Harness and Connector (MG ECU – Generator Resolver)" is a voltage test performed at MG ECU Connecter I19 and cannot be performed as written.
- Procedure does not explain that Auxiliary 12V Battery must be reconnected to provide voltage required for test.

Probable Cause

Analysis indicated that condition was caused by a malfunction inside Inverter assembly.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G920048011	G902248010	G923148010	Have part / will ship	CQEC

Repair Process

Inverter Assembly ("Inverter Assy, W/Converter" PN G9200-48011) was replaced.

- OEM Inverter assembly was recovered and will be shipped directly from Toyota Dealer to TMC via Yamato Transport after repairs are completed.
- An Inverter Cover ("Cover, Inverter" PN G9022-48010) and Gasket ("Gasket, Inverter Cover" PN G9231-48010) will be obtained from Toyota Parts system and installed on recovered

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-VGU224451	TMS	QA-Hybrid	FPE	TMS-SF	27123-1	9/19/2005

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander	2006	22-Jun-2005	726 mi	JTEDW21A960[redacted]

Condition Title

MIL ON, DTC POA7A "Generator Inverter Performance"

Inverter to protect unit during shipment.

Close-up photo of manufactures label on malfunctioning ’06 Highlander Inverter assembly.

- Top symbol sequence was: **G9200-48011**.
- Bottom symbol sequence was: **0F15WA111.**

Attachment 1: PRCS

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-VGU224451	TMS	QA-Hybrid	FPE	TMS-SF	27123-1	9/19/2005

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander	2006	22-Jun-2005	726 mi	JTEDW21A960[redacted]

Condition Title
MIL ON, DTC POA7A "Generator Inverter Performance"

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking
VIN
Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQEC	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value
1	G920048011	INVERTER ASSY, W/CONVERTER	1	$ 952 .00
	Comments:			
2	G902248010	COVER SUB-ASSY, INVERTER, UPR	1	$ 7 .00
	Comments:			
3	G923148010	GASKET, INVERTER COVER	1	$ 1 .00
	Comments:			
4				$ .00
	Comments:			
5				$ .00
	Comments:			
6				$ .00
	Comments:			
7				$ .00
	Comments:			
8				$ .00
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-70U227351	TMS	QA-Hybrid	FTS	TMS-NY	29394-1	10/28/2005

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander	2006	09-Jul-2005	31 mi	JTEEW21A660[redacted]

Condition Title

MIL Light "ON" - DTC U0110 inf. 657 Lost Communication with Driver Control Module

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
21-SEP-2005		

Condition Description

- Technician states vehicle will not Ready On.
- Technician states vehicle did Ready On during Pre-delivery Service but would not Ready On the next day.

Diagnostic Steps:

- FTS confirmed concern.
- DTC U0110 Lost Communication with Drive Motor Control Module. **(See Tech View)**
- Information Code 657 Error in reception from w/ converter inverter assembly (MG ECU) via serial communication. **(No reception)**
- Perform Diagnosis as per Repair manual.
- Check waveform signal at HV Control ECU Terminals **MTH+ (H17-28)-E1 (H14-5) & MTH- (H17-27) E1 (H14-5) No waveform signal present.**
- Check waveform signal at HV ECU Terminals **CLK+ CLK- & REQ+ REQ-. Proper waveform signal was present.**
- Ohm test for open circuit and short circuit from terminals **MTH+ & MTH-** from HV Control ECU to MG ECU. **(O.K.)**

Probable Cause

- Converter Inverter Assembly.
- UPS Tracking Number 1Z 4X4 15X 06 2643 3702

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G9200-48021			Have part / will ship	CQEC

Repair Process

- Replace Converter Inverter Assembly.

C:\Documents and Settings\sennect\Des

Tech-View File.
DTC and Freeze Frame Data

FIELD TECHNICAL REPORT

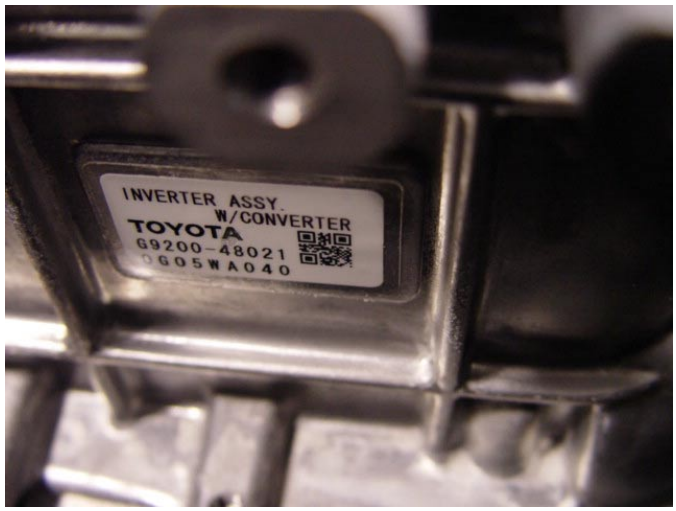
TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-70U227351	TMS	QA-Hybrid	FTS	TMS-NY	29394-1	10/28/2005

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander	2006	09-Jul-2005	31 mi	JTEEW21A660[redacted]

Condition Title

MIL Light "ON" - DTC U0110 inf. 657 Lost Communication with Driver Control Module



Place Caption #2 here

Attachment 1: PRCS

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-70U227351	TMS	QA-Hybrid	FTS	TMS-NY	29394-1	10/28/2005

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander	2006	09-Jul-2005	31 mi	JTEEW21A660[redacted]

Condition Title

MIL Light "ON" - DTC U0110 inf. 657 Lost Communication with Driver Control Module

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQEC	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value
1	G9200-48021		1	$ 0 .00
	Comments:			
2			0	$ 0 .00
	Comments:			
3			0	$ 0 .00
	Comments:			
4				$ .00
	Comments:			
5				$ .00
	Comments:			
6				$ .00
	Comments:			
7				$ .00
	Comments:			
8				$ .00
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-TPU303061A	TMS	QA-Hybrid	IDS	Servco		1/31/2006

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	06/05	2,533	JTEDW21A960[redacted]

Condition Title

MIL "ON" P0A7A Info Code 325

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
	06TR/06	

Condition Description

Sometimes warning lights including the master warning light illuminates while driving. No drivability issues felt.

Diagnostic Steps:

Warning light did not illuminate when inspected at the dealer. Found HV ECU code P0A7A with info code 325 stored in history. Inspected wires & connectors at the HV ECU & Inverter assy to be good. Freeze frame data is attached.

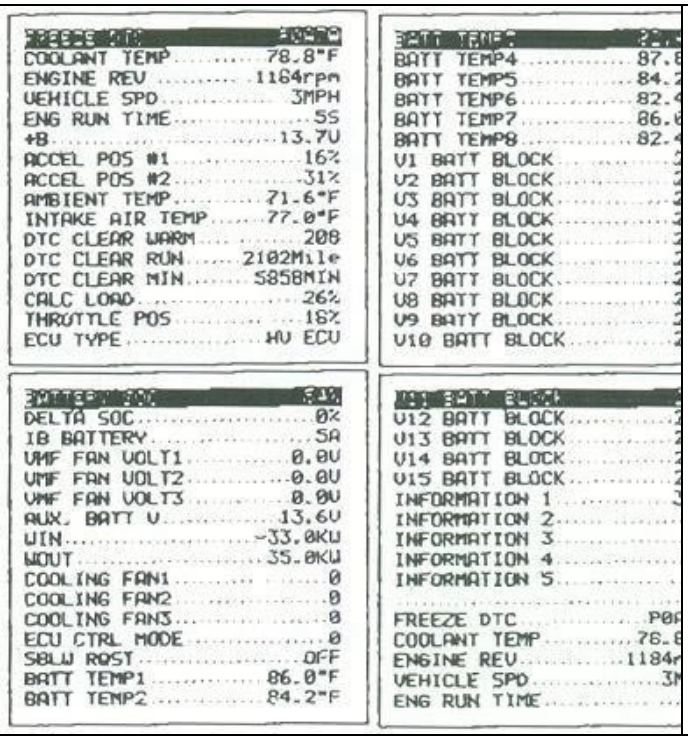
Probable Cause

Unknown.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A0-48010			Have part / will ship	CQEC

Repair Process

Replaced the inverter assy to correct the concern.



FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-TPU303061A	TMS	QA-Hybrid	IDS	Servco		1/31/2006

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	06/05	2,533	JTEDW21A960[redacted]

Condition Title

MIL "ON" P0A7A Info Code 325

Place Caption #1 here	Place Caption #2 here

Attachment 1: PRCS

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-TPU303061A	TMS	QA-Hybrid	IDS	Servco		1/31/2006

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	06/05	2,533	JTEDW21A960[redacted]

Condition Title
MIL "ON" P0A7A Info Code 325

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQEC	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value
1	G92A0-48010		1	$ 0 .00
	Comments:			
2			0	$ 0 .00
	Comments:			
3			0	$ 0 .00
	Comments:			
4				$ .00
	Comments:			
5				$ .00
	Comments:			
6				$ .00
	Comments:			
7				$ .00
	Comments:			
8				$ .00
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-VCU326461A	TMS	QA-Hybrid	FPE	TMS-DEN	30147-2	9/25/2006

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	03-Feb-2006	7270 mi	JTEEW21A960[redacted]

Condition Title

MIL Light "ON" code P0A08 -DC/DC Converter Status Circuit

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
31-AUG-2006		

Condition Description

Customer states that the engine check engine light came on.

- Vehicle was towed to dealer.

Diagnostic Steps:

1) Dim lighting indicated a discharged auxiliary battery which was confirmed by voltage test.
2) Auxiliary battery was recharged.
3) Scan tool was installed and all systems were checked for codes.
4) Code P0A08 (DC/DC Converter Status Circuit) Info 264 was retrieved and FF/Info was downloaded (below).
5) Code was cleared and didn't reset.
6) Battery indicated voltage of 12.4V with engine running in shop and amp clamp showed battery was discharging.
7) Vehicle was test driven about 4.8 miles as the auxiliary battery voltage depleted to about 10.6V when the code finally reset.

Probable Cause

Unknown

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A048020			Have part / will ship	CQEC

Repair Process

Inverter was replaced to correct the concern. Amp clamp and voltage test confirmed normal battery charging after inverter replacement.

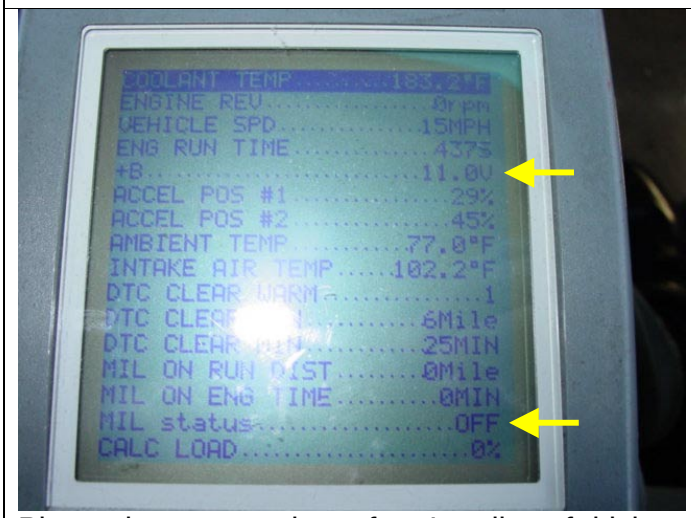


Photo above was taken after 4+ miles of driving and 15+ minutes of run time. Note: 11.0V and no MIL.

FF/Info Code:

JTEEW21A960024938.evn

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-VCU326461A	TMS	QA-Hybrid	FPE	TMS-DEN	30147-2	9/25/2006

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	03-Feb-2006	7270 mi	JTEEW21A960[redacted]

Condition Title
MIL Light "ON" code P0A08 -DC/DC Converter Status Circuit

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQEC	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)

North America EDER Gr., Technical Dept. #1
Overseas Customer Service Technical Div.
TOYOTA MOTOR CORPORTATION
Nisshin Education & Training Center
5-210, SAKAE, NISSHIN, AICH, 470-0113
Japan

Deliver to:

Attn:

Tel:

住所：

宛先：

Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value
1	G92A048020	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1515 .00
	Comments:			
2			0	$ 0 .00
	Comments:			
3			0	$ 0 .00
	Comments:			
4				$ .00
	Comments:			
5				$ .00
	Comments:			
6				$ .00
	Comments:			
7				$ .00
	Comments:			
8				$ .00
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-86U326171	TMS	QA-Hybrid	FTS	TMS-LA	30931-1	9/19/2007

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	04-Jul-2005	59734 mi	JTEDW21A560[redacted]

Condition Title

Master Warning ON, DTC P0A78 with Info 287 / 284 / 286 Inverter

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
12-SEP-2007		

Condition Description

Customer states vehicle will not start and master warning light is ON.

Diagnostic Steps:

1. DTC P0A78 (Drive Motor ''A'' Inverter Performance)
   info 1 = 287, info 2 = 284, info 3 = 286 (see freeze frame data below).
2. DTC C1259 (HV Control System Regenerative Malfunction).
3. DTC C1310 (HV System Malfunction)
4. Follow repair manual diagnostic steps for P0A78.
5. Confirm inverter coolant level is at specifications, confirm no previous collision work.
6. Confirm transaxle fluid level.

Probable Cause

Internal malfunction in inverter assembly.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G920048011			Special request only	CQEC

Repair Process

Replace inverter assembly, recheck for any DTC's, and test drive to confirm repair effectiveness.

Above: Inverter assembly removed from vehicle.

Inverter Assy W Converter
G9200-48011
0F27YA032

2006 Highlander HV 3MZ-FE
JTEDW21A560004665
59734 miles

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-86U326171	TMS	QA-Hybrid	FTS	TMS-LA	30931-1	9/19/2007

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	04-Jul-2005	59734 mi	JTEDW21A560[redacted]

Condition Title

Master Warning ON, DTC P0A78 with Info 287 / 284 / 286 Inverter

HYBRID CONTROL DTC'S (P0A78)

Code	Description	Current	Pending	History	Summary	Freeze Frame
P0A78	Drive Motor "A" Inverter Performance	X		X	Icon E	Y

Parameter	Value	Unit
Information1	287	Vref.
Information2	284	
Information3	286	
Engine Coolant Temp	192	F
Engine Revolution	4608	rpm
Vehicle Spd	29	MPH
Engine Run Time	3469	s
+B	13.75	V
Accel Pedal Pos #1	16.0	%
Accel Pedal Pos #2	31.7	%
Ambient Temperature	81	F
Intake Air Temperature	97	F
DTC Clear Warm Up	255	
DTC Clear Run Distance	34832	mile
DTC Clear Min	57637	Min
Type of ECU	HV ECU	
Calculate Load	78.7	%
Throttle Position	68.9	%
Battery State of Charge	54.5	%
Delta SOC	0.0	%
Batt Pack Current Val	9.22	A
VMF Fan Motor Voltage1	4.8	V
VMF Fan Motor Voltage2	4.4	V
VMF Fan Motor Voltage3	4.4	V
Auxiliary Battery Vol	13.4	V
Charge Control Value	-9.0	KW
Discharge Control Value	36.0	KW
Cooling Fan Mode1	4	
Cooling Fan Mode2	3	
Cooling Fan Mode3	4	
ECU Control Mode	0	
Standby Blower Request	OFF	
Temp of Batt TB1	124.5	F
Temp of Batt TB2	116.2	F
Temp of Batt TB3	109.2	F
Temp of Batt TB4	111.4	F
Temp of Batt TB5	119.8	F
Temp of Batt TB6	120.4	F
Temp of Batt TB7	118.6	F
Temp of Batt TB8	122.9	F
Battery Block Vol -V01	18.83	V
Battery Block Vol -V02	18.77	V
Battery Block Vol -V03	18.70	V
Battery Block Vol -V04	18.70	V
Battery Block Vol -V05	18.64	V
Battery Block Vol -V06	18.73	V
Battery Block Vol -V07	23.03	V
Battery Block Vol -V08	23.00	V
Battery Block Vol -V09	18.54	V
Battery Block Vol -V10	18.57	V
Battery Block Vol -V11	18.64	V
Battery Block Vol -V12	18.67	V
Battery Block Vol -V13	18.73	V
Battery Block Vol -V14	18.67	V
Battery Block Vol -V15	21.27	V
Detail Code 1	287	

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-86U326171	TMS	QA-Hybrid	FTS	TMS-LA	30931-1	9/19/2007

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	04-Jul-2005	59734 mi	JTEDW21A560[redacted]

Condition Title

Master Warning ON, DTC P0A78 with Info 287 / 284 / 286 Inverter

Parameter	Value	Unit
Detail Code 2	284	
Detail Code 3	286	
Detail Code 4	0	
Detail Code 5	0	

ABS DTCs (C1259, C1310)

Code	Description	Current	Pending	History	Summary	Freeze Frame
C1259	HV Control System Regenerative Malfunction	X			Icon C	N
C1310	HV System Malfunction	X			Icon C	Y

Parameter	Value -3	-2	-1	0	1	Unit
Detailed Freeze DTC				156		
Elapsed Time after Freeze Trigger		0	0	156		msec
Number of IG ON		0	0	0		
Elapsed Time				30		sec
Buzzer		OFF	OFF	OFF		
Stop Light SW		OFF	OFF	OFF		
Parking Brake SW		OFF	OFF	OFF		
Reservoir Warning SW		OFF	OFF	OFF		
Shift Lever Position		P,N	P,N	P,N		
Operated System		Non	Non	Non		
Master Cylinder Sensor		0.47	0.47	0.47		V
M/C Sensor Grade		0	0	0		MPa/s
Master Cylinder Sensor2				0.47		V
Stroke Sensor		0.94	0.94	0.94		V
Stroke Sensor2				3.90		V
Accumulator Sensor				3.47		V
Yaw Rate Sensor		0	0	0		degrees/s
Steering Angle Sensor		1143	1143	1143		degrees
FR W/C Sensor				0.45		V
FL W/C Sensor				0.47		V
RR W/C Sensor				0.47		V
RL W/C Sensor				0.45		V
Lateral G		-0.39	-0.39	-0.39		m/s2
Forward and Rearward G		0.00	0.00	0.00		m/s2
FR Wheel Speed		0	0	0		MPH
FL Wheel Speed		0	0	0		MPH
RR Wheel Speed		0	0	0		MPH
RL Wheel Speed		0	0	0		MPH
Vehicle Speed		0	0	0		MPH
Accelerator Opening Angle %		0.0	0.0	0.0		%
ECB Motor Relay				OFF		
ECB Motor Relay2				OFF		
ECB Main Relay				ON		
ECB Main Relay2				ON		
ECB Solenoid (SMC1)				OFF		
ECB Solenoid (SMC2)				OFF		
ECB Solenoid (SMC2)				OFF		
ECB Solenoid (SCSS)				ON		
Capacitor Mode				OFF		
IG1 Voltage Value				13.72		V
IG2 Voltage Value				13.56		V
BS1 Voltage Value				13.17		V
BS2 Voltage Value				13.41		V
VM1 Voltage Value				13.01		V
VM2 Voltage Value				12.94		V
+B1 Voltage Value				13.80		V
+B2 Voltage Value				13.88		V
Motor Relay Voltage Value				0.00		V
SLAFR Solenoid Current				0.00		A
SLAFL Solenoid Current				0.00		A
SLARR Solenoid Current				0.00		A
SLARL Solenoid Current				0.00		A
SLRFR Solenoid Current				0.00		A
SLRFL Solenoid Current				0.00		A
SLRRR Solenoid Current				0.00		A

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
FTR-86U326171	TMS	QA-Hybrid	FTS	TMS-LA	30931-1	9/19/2007

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	04-Jul-2005	59734 mi	JTEDW21A560[redacted]

Condition Title

Master Warning ON, DTC P0A78 with Info 287 / 284 / 286 Inverter

Attachment 1: PRCS

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQEC	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value
1	G920048011	INVERTER ASSY, W/CONVERTER	1	$ 952 .00
	Comments:			
2			0	$ 0 .00
	Comments:			
3			0	$ 0 .00
	Comments:			
4				$ .00
	Comments:			
5				$ .00
	Comments:			
6				$ .00
	Comments:			
7				$ .00
	Comments:			
8				$ .00
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080300003	TMS	QAHybrid	PE	TMS	80309212	01/30/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-05-25	42432	JTEDW21A860[redacted]

Condition Title

Master Warning ON, DTC P0A78 with Information 286 and 287

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
1/2/2008		

Condition Description

Customer states the car would go to “Ready ON” then shut off. The master warning light was ON.

Technician verified master warning ON condition. Technician also verified that the car would go to “Ready ON” mode but had no mobility in “Reverse” or “Drive” modes.

Diagnostic Steps:

Technician used scan tool and retrieved the following Diagnostic Trouble Code (DTC):
P0A78 (Drive Motor “A” Inverter Performance) with information 286 and 287.

Repair manual diagnostics indicated that an inverter malfunction caused the master warning light ON condition and non-functional state of MG2 circuit.

Probable Cause

Cause of malfunction within MG2 circuit of inverter assembly not known.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G920048011			Have part / will ship	CQE

Repair Process

Technician replaced inverter assembly. Vehicle mobility restored.

Photo of Inverter Assembly

Photo of Inverter Serial Number
0E18WA136

Freeze Frame Data (Techstream format)

HHV_FFD_0002912.
TSE

Attachment 1: PRCS

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080300003	TMS	QAHybrid	PE	TMS	80309212	01/30/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-05-25	42432	JTEDW21A860[redacted]

Condition Title

Master Warning ON, DTC P0A78 with Information 286 and 287

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	G920048011	INVERTER ASSY, W/CONVERTER	1	$ 952.74
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080390010	TMS	QAHybrid	PE	TMS	80429688	02/11/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-05-24	42262	JTEDW21A560[redacted]

Condition Title

Vehcile will not start, IGCT Fuse

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
12/26/2007		

Condition Description

- Customer states car would not start. Customer also states Master Warning Light is ON.

Diagnostic Steps:

- No CAN communication with the HV ECU
- IGCT NO. 2 Fuse blown upon arrival at dealership.
- Technician replaced blown IGCT NO. 2 Fuse. When attempting to re-start vehicle, fuse was blown again.
- Technician disconnected the Inverter connectors and the replacement IGCT NO. 2 Fuse remained intact.
- Technician removed Inverter cover and noticed an unusual odor inside.

Probable Cause

- Cause malfunction within the Inverter Assembly is unknown.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A048090			Have part / will ship	CQE

Repair Process

Replaced the Inverter Assembly and IGCT No. 2 Fuse.

Photo of Inverter Assembly

Inverter Serial Number
OE18YA047

Attachment 1: PRCS

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080390010	TMS	QAHybrid	PE	TMS	80429688	02/11/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-05-24	42262	JTEDW21A560[redacted]

Condition Title
Vehcile will not start, IGCT Fuse

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,291.55
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080560028	SET	QAHybrid	FTS	REG-SET	80309212	03/04/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-10-03	48200	JTEDW21A760[redacted]

Condition Title

MIL Light 'ON' Code P0A78- Drive Motor A Inverter Performance

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
2/15/2008		

Condition Description

- MIL light ‘ON’ with codes P0A94, P0A7A, and P0A78

Diagnostic Steps:

- Checked the connections of the wiring harness to the HV ECU
- Checked the connections of the wiring harness to the MG ECU
- Ensured proper connections at the Hybrid Inverter/Converter and Transaxle
- Checked resistance of HV three-phase cables for proper resistance
- Checked for proper resistance at the generator resolver

Probable Cause

- Open circuit in the Hybrid Inverter/Converter

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A048010			Special request only	CQE

Repair Process

- Replaced Hybrid Inverter/Converter Assembly

Attachment 1: PRCS

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080560028	SET	QAHybrid	FTS	REG-SET	80309212	03/04/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-10-03	48200	JTEDW21A760[redacted]

Condition Title

MIL Light 'ON' Code P0A78- Drive Motor A Inverter Performance

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048010	INVERTER ASSY, HV MOTOR CONTROL	1	$ 971.18
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080570036	SET	QAHybrid	FTS	REG-SET	80309212	03/04/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-09-07	34877	JTEEW21A460[redacted]

Condition Title

MIL Light "ON" Code U0293 - Lost Communication with HV ECU

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
2/15/2008		

Condition Description

Vehicle would loose power while driving

Diagnostic Steps:

Test drove vehicle and was able to verify condition.
When vehicle lost power, tech found codes C1241 and U0293
Also Fuse IGT2 would blow
Replaced fuse, test drove, fuse would blow again and set same codes

Probable Cause

Inverter failure

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
8998148100	G92A048080		Have part / will ship	CQE

Repair Process

Replace inverter and HV ecu

PLACE PICTURE # 1 HERE	PLACE PICTURE # 2 HERE

Attachment 1: PRCS

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080570036	SET	QAHybrid	FTS	REG-SET	80309212	03/04/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-09-07	34877	JTEEW21A460[redacted]

Condition Title

MIL Light "ON" Code U0293 - Lost Communication with HV ECU

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	8998148100	COMPUTER, HYBRID VEHICLE CONTROL	1	$ 128.12
	Comments:			
2	G92A048080	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,137.67
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080570039	SET	QAHybrid	FTS	REG-SET	80309212	03/10/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-06-16	60570	JTEDW21A960[redacted]

Condition Title

MIL light "ON" Code P0A78 Drive Motor "A" Inverter Performance

Do not type in YELLOW shaded fields - Input data from Web page or RDM:

Repair Date	Optional Ref.	Optional Approval
1/31/2008		

Condition Description

- MIL 'ON' w/ P3222, P0AEF, P0A7A, P0A78, P0A75, P0A72, P0A63, and P0A60

Diagnostic Steps:

- Performed multiple checks for proper pin fit and connector fit
- Checked for proper resistance of three-phase A/C cables

Probable Cause

- Internal Inverter/Converter Malfunction

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A048090			Have part / will ship	CQE

Repair Process

- Replace Inverter/Converter
- FFD not available

Attachment 1: PRCS

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-080570039	SET	QAHybrid	FTS	REG-SET	80309212	03/10/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-06-16	60570	JTEDW21A960[redacted]

Condition Title

MIL light "ON" Code P0A78 Drive Motor "A" Inverter Performance

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,291.55
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			

DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Dealer Code	Ref	Date
TQCN_DPR-081150059	TMS	QAHybrid	MDT/DS	04338	80309212	04/28/2008

Dealer Name	Dealer City	State	Region
FREMONT TOYOTA	FREMONT	CA	SFR

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	22-AUG-05	38072 mi	JTEDW21AX60[redacted]

Condition Title

MIL "ON" Code U0293 - Lost Communication with HV Control ECU

Repair Date	Optional Ref.	Applicable DTC Code(s)
4/24/2008		U0293/252

Condition Description

CUSTOMER STATES VEHICLE LOST POWER WHILE TAKING OFF RAMP AND THEN VEHICLE WOULD NOT RUN ON BATTERY POWER. CUSTOMER NOTICED ENGINE COOLING FAN CYLING CONTINUOUSLY.

Diagnostic Steps:

AUXILLARY BATTERY TESTED AND FAILED.
10 AMP IGCT NO. 2 FUSE BLOWN.
TRACE CIRCUIT AND ISOLATED INVERTER ASSEMBLY, SHORT WENT AWAY AND COMMUNICATION ESTABLISHED WITH HV ECU AGAIN.

Probable Cause

UNKNOWN

Part # 1:	Part # 2:	Part # 3:	Parts Available on Request:	Parts Shipping Destination:
G92A048090	0054451R60	9098209009	Available upon request	CQE

Repair Process

REPLACED INVERTER ASSEMBLY AND FUSE. REINITIALIZE AND ROAD TEST.

DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Dealer Code	Ref	Date
TQCN_DPR-081150059	TMS	QAHybrid	MDT/DS	04338	80309212	04/28/2008

Dealer Name	Dealer City	State	Region
FREMONT TOYOTA	FREMONT	CA	SFR

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	22-AUG-05	38072 mi	JTEDW21AX60[redacted]

Condition Title

MIL "ON" Code U0293 - Lost Communication with HV Control ECU

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value Each

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 971.18
	Comments:			
2	0054451R60	n/a	1	$ 0.00
	Comments:			
3	9098209009	FUSE, MINI	1	$ 0.05
	Comments:			
4				$
	Comments:			
5				$
	Comments:			
6				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-081430073	TMS	QAHybrid	FTS	REG-LA	81486934	05/27/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-07-21	80277	JTEDW21A760[redacted]

Condition Title

MIL Light "ON" Code P0A78 Drive Motor A Inverter Performance

Do not type in YELLOW shaded fields – This data is auto-populated from the TQCN system:

Repair Date	Optional Ref.	Optional Approval
3/29/2008		

Condition Description

Customer states the vehicle will not move when accelerated. Car will Ready-ON but will not accelerate MIL, VSC TRAC lights on.

Diagnostic Steps:

- Found the following diagnostic codes as Current and History DTC's:
  P0A78 / 286 (Drive Motor 'A' Inverter Performance)
  P0A7A (Generator Inverter Performance)
  P0A94 (DC/DC Converter Performance)
  C1310 (Malfunction in HV system)
  C1259 (HV System Regenerative Malfunction).
- Clear DTC's and then the vehicle would Ready-ON, but vehicle would not move when accelerated in Drive or Reverse. No accelerator pedal response.
- Check engine light would return shortly with the same DTC's.
- Follow repair manual diagnostics for P0A78, conclude fault in inverter assembly.

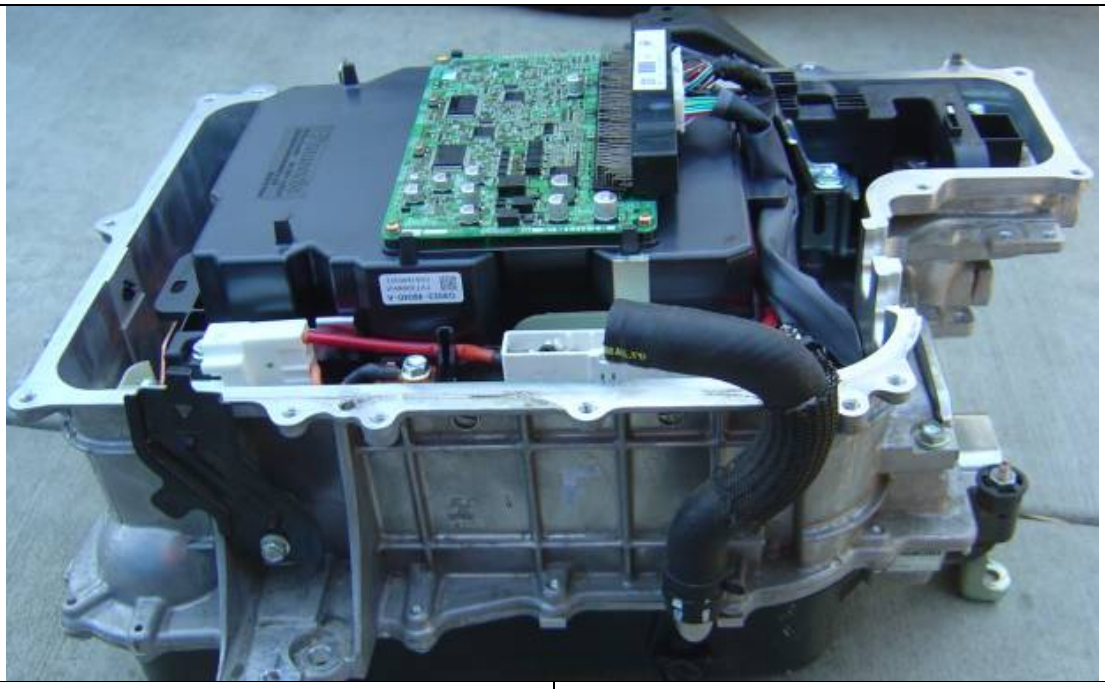
Probable Cause

Internal fault in the Inverter w Converter assembly.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A048090			Manual Part Return	CQE

Repair Process

Replace HV Inverter w Converter assembly. Road test vehicle and confirm no further DTC's were output.



Right: Calibrations in vehicle at time of DTC check:	Hybrid Control Calibration 899834807000 Hybrid Control Calibration 898824802201 Hybrid Control Calibration 898824802202 Engine ECT Control Calibration 3482700

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-081430073	TMS	QAHybrid	FTS	REG-LA	81486934	05/27/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-07-21	80277	JTEDW21A760[redacted]

Condition Title

MIL Light "ON" Code P0A78 Drive Motor A Inverter Performance

Vehicle Diagnostic Report

2006 Highlander HV 3MZ-FE

JTEDW21A760[redacted]

Freeze Frame Data Report

P0A78(1 of 1)

Parameter	Value	Unit
Information1	286	
Engine Coolant Temp	185	F
Engine Revolution	1760	rpm
Vehicle Spd	0	MPH
Engine Run Time	761	s
+B	13.63	V
Accel Pedal Pos #1	16.0	%
Accel Pedal Pos #2	31.7	%
Ambient Temperature	82	F
Intake Air Temperature	95	F
DTC Clear Warm Up	0	
DTC Clear Run Distance	0	mile
DTC Clear Min	0	Min
Type of ECU	HV ECU	
Calculate Load	11.7	%
Throttle Position	17.6	%
Battery State of Charge	43.0	%
Delta SOC	0.0	%
Batt Pack Current Val	6.51	A
VMF Fan Motor Voltage1	2.6	V
VMF Fan Motor Voltage2	2.6	V
VMF Fan Motor Voltage3	2.2	V
Auxiliary Battery Vol	13.4	V
Charge Control Value	-10.0	KW
Discharge Control Value	35.0	KW
Cooling Fan Mode1	3	
Cooling Fan Mode2	3	
Cooling Fan Mode3	4	
ECU Control Mode	0	
Standby Blower Request	OFF	
Temp of Batt TB1	117.9	F
Temp of Batt TB2	119.5	F
Temp of Batt TB3	115.3	F
Temp of Batt TB4	121.8	F
Temp of Batt TB5	113.5	F
Temp of Batt TB6	118.6	F
Temp of Batt TB7	123.3	F
Temp of Batt TB8	117.3	F
Battery Block Vol -V01	20.88	V
Battery Block Vol -V02	20.82	V
Battery Block Vol -V03	20.85	V
Battery Block Vol -V04	20.79	V
Battery Block Vol -V05	20.92	V
Battery Block Vol -V06	20.96	V
Battery Block Vol -V07	20.88	V
Battery Block Vol -V08	20.85	V
Battery Block Vol -V09	20.88	V
Battery Block Vol -V10	20.92	V
Battery Block Vol -V11	20.92	V
Battery Block Vol -V12	20.92	V

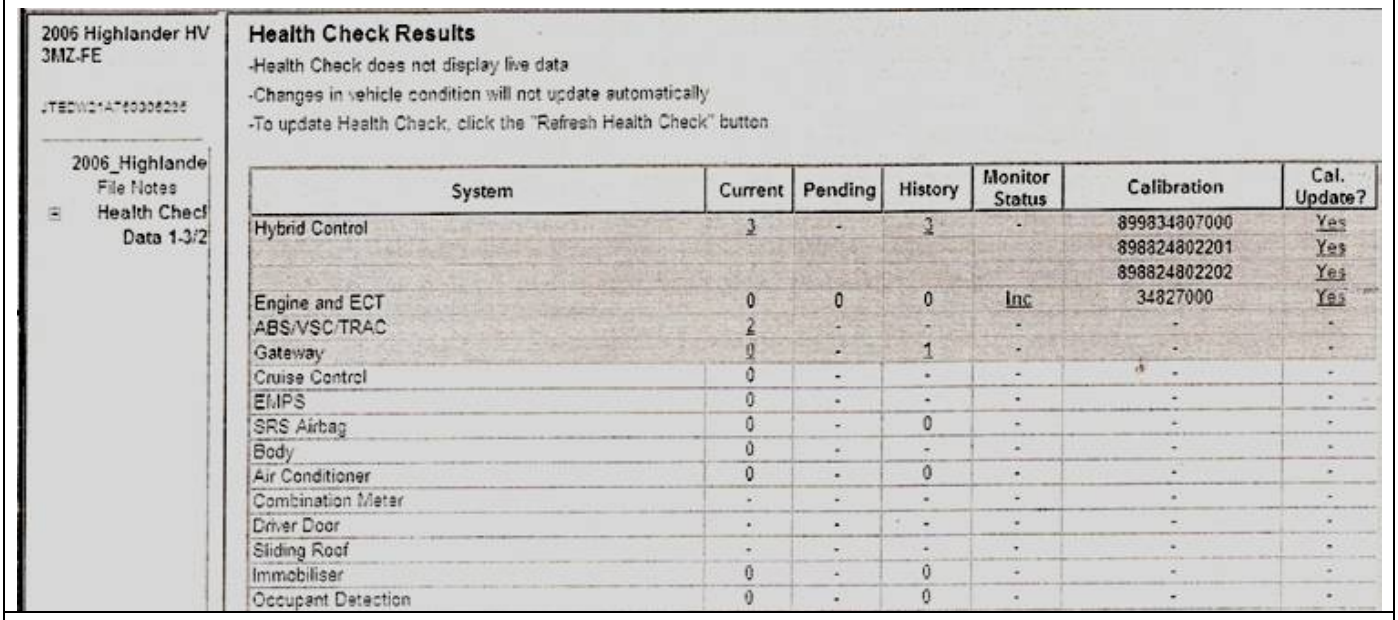
TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-081430073	TMS	QAHybrid	FTS	REG-LA	81486934	05/27/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-07-21	80277	JTEDW21A760[redacted]

Condition Title

MIL Light "ON" Code P0A78 Drive Motor A Inverter Performance

Battery Block Vol -V12	20.92	V
Battery Block Vol -V13	20.88	V
Battery Block Vol -V14	20.82	V
Battery Block Vol -V15	20.92	V
Detail Code 1	286	
Detail Code 2	0	
Detail Code 3	0	
Detail Code 4	0	
Detail Code 5	0	



2006 Highlander HV
3MZ-FE

JTEDW21A760306235

2006_Highlande
File Notes
Health Chec
Data 1-3/2

Health Check Results

-Health Check does not display live data
-Changes in vehicle condition will not update automatically
-To update Health Check, click the "Refresh Health Check" button

System	Current	Pending	History	Monitor Status	Calibration	Cal. Update?
Hybrid Control	3	-	3	-	899834807000	Yes
					898824802201	Yes
					898824802202	Yes
Engine and ECT	0	0	0	Inc	34827000	Yes
ABS/VSC/TRAC	2	-	-	-	-	-
Gateway	0	-	1	-	-	-
Cruise Control	0	-	-	-	-	-
EMPS	0	-	-	-	-	-
SRS Airbag	0	-	0	-	-	-
Body	0	-	-	-	-	-
Air Conditioner	0	-	0	-	-	-
Combination Meter	-	-	-	-	-	-
Driver Door	-	-	-	-	-	-
Sliding Roof	-	-	-	-	-	-
Immobiliser	0	-	0	-	-	-
Occupant Detection	0	-	0	-	-	-

BELOW: Inverter assembly part labels / identification:

Label on outside case of inverter assembly:

G9200-48011
0G13WA061

Label inside inverter:

MG_FF_03 V0561W 0421

G9023-48040-A
TVT309WHA
C561840022

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-081430073	TMS	QAHybrid	FTS	REG-LA	81486934	05/27/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-07-21	80277	JTEDW21A760[redacted]

Condition Title

MIL Light "ON" Code P0A78 Drive Motor A Inverter Performance

Label inside inverter:

FEG13019

Replacement part information:

G92A0-48090

2006 HV Highlander JTEDW21A760[redacted] 80277 miles

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Orig Tracking

VIN [redacted]

Doc No.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part # 1:	Part Description	Qty.	Used Part Value Each
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 971.18
	Comments:			
2	**Part # 2:**	**Part Description**	**Qty.**	**Used Part Value Each** $

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-081430073	TMS	QAHybrid	FTS	REG-LA	81486934	05/27/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-07-21	80277	JTEDW21A760[redacted]

Condition Title

MIL Light "ON" Code P0A78 Drive Motor A Inverter Performance

	Comments:			
3	**Part # 3:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			
4	**Part # 4:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			
5	**Part # 5:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			
6	**Part # 6:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			
7	**Part # 7:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-082340003	TMS	QAHybrid	FTS	REG-NY	80277975	08/21/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-11-02	91000	JTEEW21A960[redacted]

Condition Title

Master Warning ON, DTC P0A78 with Information 286

Do not type in YELLOW shaded fields – This data is auto-populated from the TQCN system:

Repair Date	Optional Ref.	Optional Approval
8/12/2008		

Condition Description

Customer states vehicle will not move in any selected gear range.

Diagnostic Steps:

- Technician performed health check and had DTC P0A78 with information code 286.
- Technician followed repair manual for diagnosis on DTC and found inverter has internal failure.

Probable Cause

Cause of internal malfunction within inverter assembly is not known.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G920048021			Part(s) Available	CQE

Repair Process

Technician replaced inverter and DTC P0A78 condition is no longer present.

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-082340003	TMS	QAHybrid	FTS	REG-NY	80277975	08/21/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-11-02	91000	JTEEW21A960[redacted]

Condition Title

Master Warning ON, DTC P0A78 with Information 286

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Orig Tracking

VIN

Doc No.

[redacted]

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	G920048021	INVERTER ASSY, W/CONVERTER	1	$ 1,124.20
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			
6				$
	Comments:			
7				$
	Comments:			

DEALERSHIP PRODUCT REPORT

TQCN DOC#	Affiliate	Dept.	Source	Dealer Code	Ref	Date
TQCN_DPR-082460035	TMS	QAHybrid	MDT/DS	04508	80271375	09/29/2008

Dealer Name	Dealer City	State	Region
MANHATTAN BEACH TOYOTA	MANHATTAN BEACH	CA	LOS

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	12-MAY-06	11055 mi	JTEDW21A160[redacted]

Condition Title

Vehicle Will Not Start, Inverter Malfunction

Repair Date	Optional Ref.	Applicable DTC Code(s)
8/29/2008		

Condition Description

Vehicle will not start; no check engine light and no “Ready” light.

Diagnostic Steps:

Followed repair manual procedures and found no power source feeding Hybrid ECU.

Found short circuit causing 10-Amp IGCT 2 fuse to blow. Short circuit found to be inside HV Inverter.

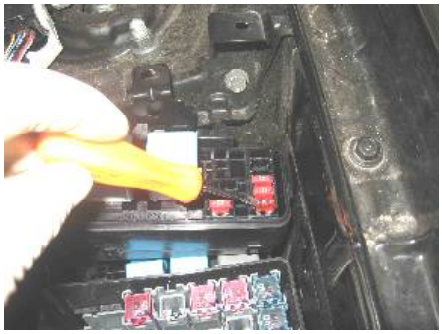
Probable Cause

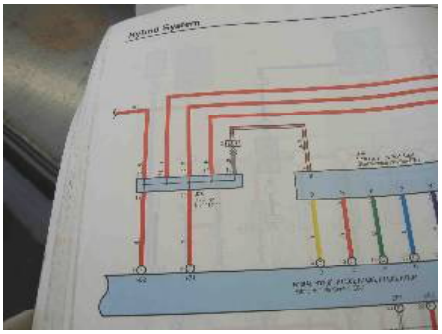
Cause inverter malfunction not known.

Part # 1:	Part # 2:	Part # 3:	Parts Available on Request:	Parts Shipping Destination:
G92A048090	G92AO48090		Available upon request	CQE

Repair Process

Replaced HV Inverter and validated repair.





DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Dealer Code	Ref	Date
TQCN_DPR-082460035	TMS	QAHybrid	MDT/DS	04508	80271375	09/29/2008

Dealer Name	Dealer City	State	Region
MANHATTAN BEACH TOYOTA	MANHATTAN BEACH	CA	LOS

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	12-MAY-06	11055 mi	JTEDW21A160[redacted]

Condition Title

Vehicle Will Not Start, Inverter Malfunction

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN [redacted]

Doc No.

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value Each

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 965.20
	Comments:			
2	G92AO48090	n/a	1	$ 0.00
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			
6				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-082880047	TMS	QAHybrid	PE	TMS	80267593	10/15/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2006-05-16	17687	JTEDW21AX60[redacted]

Condition Title

Master Warning Light “ON” P0A78 (Drive Motor "A" Inverter Performance)

Do not type in YELLOW shaded fields – This data is auto-populated from the TQCN system:

Repair Date	Optional Ref.	Optional Approval
10/10/2008		

Condition Description

Customer states they heard a thump and lost power. The engine continued to run but the vehicle would not move. The customer had the vehicle towed to the dealer.

Diagnostic Steps:

Connected Techstream to the vehicle and found P0A78/286,P0A7A/325 and P0A94/555 set.
Followed the repair procedure for a P0A78/286
Contacted TAS for confirmation

Probable Cause

Replaced the Inverter and test drove vehicle, no problem found.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A048090			Part(s) Available	CQE

Repair Process

Replaced the Inverter and test drove vehicle no problem found.

2006 Highlander HV JTEDW21AX600[redacted]	P0A78 Customer Survey .TIF
Highlander Freeze Frame data	P0A78 Customer Questionnaire

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-082880047	TMS	QAHybrid	PE	TMS	80267593	10/15/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2006-05-16	17687	JTEDW21AX60[redacted]

Condition Title

Master Warning Light “ON” P0A78 (Drive Motor "A" Inverter Performance)

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is “**scrap**”, properly dispose of the part.

Orig Tracking

VIN

Doc No.

[redacted]

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 965.20
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			
6				$
	Comments:			
7				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-082950027	TMS	QAHybrid	FTS	REG-NY	82966466	10/22/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-10-27	150005	JTEEW21A760[redacted]

Condition Title

Master Warning Light ON, DTC P0A78 and P0A90

Do not type in YELLOW shaded fields – This data is auto-populated from the TQCN system:

Repair Date	Optional Ref.	Optional Approval
9/8/2008		

Condition Description

Customer states: The vehicle shut off while driving, and master warning light is on.
***NOTE* vehicle is a NY City TAXI CAB.** Inverter was replaced at 75000 miles.

Diagnostic Steps:

Technician inspected and confirmed customer's concern.
Retrieved codes from HV system.

1. P0A78 Drive motor A inverter performance
2. P0A90 Drive motor A inverter performance

Technician followed repair manual inspection instructions.
Found internal fault in inverter.

Probable Cause

Cause within inverter assembly not known.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A048080			Part(s) Available	CQE

Repair Process

Technician replaced inverter assembly.

Inverter assembly

Inverter serial # QD09WM072

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-082950027	TMS	QAHybrid	FTS	REG-NY	82966466	10/22/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2005-10-27	150005	JTEEW21A760[redacted]

Condition Title

Master Warning Light ON, DTC P0A78 and P0A90

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Orig Tracking

VIN

Doc No.

[redacted]

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048080	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,130.86
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			
6				$
	Comments:			
7				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-083010054	TMS	QAHybrid	FTS	REG-NY	80277975	10/27/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2006-03-22	161016	JTEEW21AX60[redacted]

Condition Title

Master Warning Light ON, DTC P0A78

Do not type in YELLOW shaded fields – This data is auto-populated from the TQCN system:

Repair Date	Optional Ref.	Optional Approval
10/22/2008		

Condition Description

Customer states: The vehicle shut off while driving, master warning light is on.
***NOTE* vehicle is a NY City TAXI CAB.**

Diagnostic Steps:

Technician inspected and confirmed customer's concern.
Retrieved codes from HV system.

1. P0A78 Drive motor A inverter performance with info code 286/287

Technician followed repair manual inspection instructions.
Found internal malfunction in inverter.

Probable Cause

Cause within inverter assembly not known.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A048080			Part(s) Available	CQE

Repair Process

Technician replaced inverter assembly.

Inverter assembly

Inverter serial # PC17YA014

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-083010054	TMS	QAHybrid	FTS	REG-NY	80277975	10/27/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2006-03-22	161016	JTEEW21AX60[redacted]

Condition Title

Master Warning Light ON, DTC P0A78

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Orig Tracking

VIN

Doc No.

[redacted]

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048080	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,130.86
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			
6				$
	Comments:			
7				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-083010060	TMS	QAHybrid	FTS	REG-NY	80277975	10/28/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2006-05-17	178778	JTEEW21A960[redacted]

Condition Title

Master Warning Light ON, DTC P0A78

Do not type in YELLOW shaded fields – This data is auto-populated from the TQCN system:

Repair Date	Optional Ref.	Optional Approval
8/21/2008		

Condition Description

Customer states: The vehicle shut off while driving, master warning light is on.
***NOTE* vehicle is a NY City TAXI CAB.**

Diagnostic Steps:

Technician inspected and confirmed customer's concern.
Retrieved codes from HV system.

1. P0A78 Drive motor A inverter performance with info code 286/287

Technician followed repair manual inspection instructions.
Found internal malfunction in inverter.

Probable Cause

Cause within inverter assembly not known.

Part # 1:	Part # 2:	Part # 3:	Parts Disposition:	Parts Shipping Destination:
G92A048080			Part(s) Available	CQE

Repair Process

Technician replaced inverter assembly.

Inverter assembly

Inverter serial # PE10YA051

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Location	Ref	Date
TQCN_FTR-083010060	TMS	QAHybrid	FTS	REG-NY	80277975	10/28/2008

Problem Area	Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Base Vehicle	Highlander HV	2006	2006-05-17	178778	JTEEW21A960[redacted]

Condition Title

Master Warning Light ON, DTC P0A78

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Orig Tracking

VIN

Doc No.

[redacted]

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048080	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,130.86
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			
6				$
	Comments:			
7				$
	Comments:			

DEALERSHIP PRODUCT REPORT

TQCN DOC#	Affiliate	Dept.	Source	Dealer Code	Ref	Date
TQCN_DPR-083190038	TMS	QAHybrid	MDT/DS	04317	82966466	11/18/2008

Dealer Name	Dealer City	State	Region
DOWNTOWN TOYOTA	OAKLAND	CA	SFR

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	08-MAY-06	36722 mi	JTEEW21A960[redacted]

Condition Title

Master Warning Light ON, DTC P0A7A with Info 325

Repair Date	Optional Ref.	Applicable DTC Code(s)
11/14/2008		P0A7A/325

Condition Description

Customer states vehicle will not start and all dash lights are on.

Diagnostic Steps:

The MG ECU is transmitting that the inverter circuit has a problem. The RM procedure recommends use of a milli-ohmmeter, but dealership is not equipped with this tool. MG1 voltage was checked when the DTC set. The PWM voltage from the inverter to MG1 is not correct. The voltage produced from MG1 in generation mode appears ok. This verified that the windings are not shorted and the inverter is the problem. See attached graph.

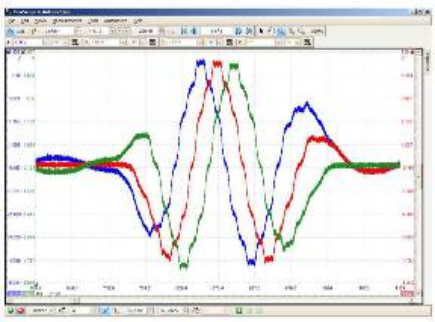
Probable Cause

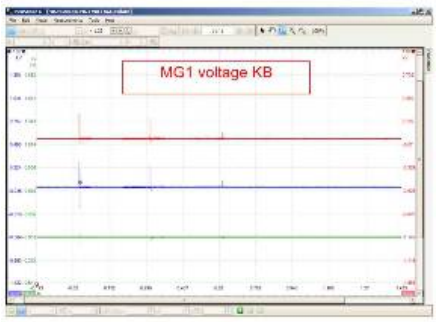
Suspect inverter internal malfunction.

Part # 1:	Part # 2:	Part # 3:	Parts Available on Request:	Parts Shipping Destination:
G92A048080			Available upon request	CQE

Repair Process

The inverter was replaced.





Freeze Frame Data attached:
(Techstream format)

P0A7A 2006_Highlander HV_3MZ-FE_JTEEW21A960031114_11-12-2008 83616 AM.TSE

DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Source	Dealer Code	Ref	Date
TQCN_DPR-083190038	TMS	QAHybrid	MDT/DS	04317	82966466	11/18/2008

Dealer Name	Dealer City	State	Region
DOWNTOWN TOYOTA	OAKLAND	CA	SFR

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	08-MAY-06	36722 mi	JTEEW21A960[redacted]

Condition Title

Master Warning Light ON, DTC P0A7A with Info 325

Attachment 1: **Parts Recovery Control Sheet**

Orig Tracking

VIN [redacted]

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Doc No.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value Each

	Part #	Part Description	Qty.	Used Part Value Each
1	G92A048080	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,130.86
	Comments:			
2				$
	Comments:			
3				$
	Comments:			
4				$
	Comments:			
5				$
	Comments:			
6				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Date
TQCN_FTR-083360019	TMS	QAHybrid	12/03/2008

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2006-05-29	23789	JTEDW21A360[redacted]

Source	Location	Problem Area	Repair Date
PE	TMS	Base Vehicle	11/26/2008

Part # 1:	Part # 2:	Part # 3:	Parts Destination:	Parts Available:
G92A048100			CQE	No Part(s) Available

Condition Title	Ref
IGCT Number 2 Fuse Open	80429688

Condition Description

Customer states on acceleration from a stop, the vehicle surged, shut down and would not restart. Vehicle was towed to the dealer. Technician could not get Techstream to communicate with the HV ECU and Engine ECM.

Diagnostic Steps:

- Technician found the IGCT #2 fuse open. He replaced the IGCT #2 fuse with a known good fuse. The fuse went open when Ready ON was attempted.
- IGCT #2 circuit was found to have continuity to ground.
- Technician contacted TAS for assistance.
- As instructed Technician disconnected the I18 connecter and IGCT #2 circuit lost continuity to ground.
- The technician removed the inverter cover and noted an unusual odor coming from inside the inverter.

Probable Cause

Internal Inverter short circuit.

Repair Process

Replaced Inverter

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_FTR-083360019	IGCT Number 2 Fuse Open	12/03/2008

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	**2006**	**2006-05-29**	**23789**	JTEDW21A360[redacted]

Orig Tracking

VIN

Doc No.

[redacted]

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所:
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn:	宛先:
	Tel:	Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each
1	**Part # 1:** G92A048100	**Part Description** INVERTER ASSY, HV MOTOR CONTROL	**Qty.** 1	**Used Part Value Each** $ 1,402.48
	Comments:			
2	**Part # 2:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			
3	**Part # 3:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			
4	**Part # 4:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			
5	**Part # 5:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			
6	**Part # 6:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			
7	**Part # 7:**	**Part Description**	**Qty.**	**Used Part Value Each** $
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Ref	Date
TQCN_FTR-091310048	TMS	QAHybrid	No Matching	05/13/2009

Primary Model	Model Year	Production Date	Odometer	VIN	Repair Date
Highlander HV	2006	2006-05-25	57344	JTEEW21A660[redacted]	4/1/2009

Source	Location	Problem Area	Parts Destination	DTC
PE	TMS-PQSS	Base Vehicle	CQE	P0A60/501,P0A63/502,P0A78/272,P0AEF/275

Part # 1	Part # 1 Serial/Date Code	Part # 2	Part # 2 Serial/Date Code	Parts Available
G92A048080				Manual Part Return

Condition Title

Master Warning Light "ON" Code P0A60 - Drive Motor "A" Phase V Current

Condition Description

Customer states the Master Warning Light is “ON” and vehicle will not move.

Diagnostic Steps

- Tech retrieved DTCs P0A60, P0A63, P0A78, P0AEF
- Cleared codes and all 4 codes immediately reset
- Original FFD indicated that P0A60/501 set first.
- MG1 temp was 70 degrees, MG2 temp was 302 degrees

Probable Cause

Internal malfunction in Inverter Assembly.

Repair Process

Replaced Inverter Assembly.

tempInboxAttach2006_Highlander HV_3MZ-FE_JTEEW21A660[redacted]4-1-2009 74727 AM1238587[redacted]TSE

FFD

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_FTR-091310048	Master Warning Light "ON" Code P0A60 - Drive Motor "A"	05/13/2009

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2006-05-25	57344	JTEEW21A660[redacted]

Orig Tracking

VIN [redacted]

Doc No.

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所:
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先: Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each	Serial No. / Date Code	Comments:
1	G92A048080	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,461.80		
2				$		
3				$		
4				$		
5				$		
6				$		
7				$		

DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Dealer Code	Ref	Date
TQCN_DPR-091950032	**TMS**	QAHybrid	**13024**	80277975	07/20/2009

Dealer Name	Dealer City	State	Region	Source
BUTLER TOYOTA	INDIANAPOLIS	IN	CHI	**TECH**

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	07-JUN-05	48968 mi	JTEDW21A560[redacted]

Part # 1:	Part # 2:	Part # 3:	Parts Destination:	Parts Available:	Repair Date
G92A048090	00272SLLC2		CQE	Available upon request	7/14/2009

Condition Title	Applicable DTC Code(s)
Master Warning Light "ON" Code P0A78 - Drive Motor "A" Inverter Performance	P0A94,P0A7A,P0A78/287,P0A78/286,P2118,C1319,C1241

Condition Description

Customer stated at a stop went to accelerate across the street, let off pedal, stepped back on pedal and heard a clunk noise and then warning lights came on and car shut down.

Diagnostic Steps:

Tried to ready on vehicle would no ready on.

Checked codes, stored FFD and then cleared codes.

P0A78/287 code returned. After code was cleared vehicle would ready on for about 3 seconds then display master warning again.

Checked MG ECU connections they were good.

Probable Cause

Possible inverter internal error.

Repair Process

R&R Inverter converter assembly, condition resolved.

zRDMObjectFile.zip

DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_DPR-091950032	Master Warning Light "ON" Code P0A78 - Drive Motor "A" Inverter Performance	07/20/2009

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	07-JUN-05	48968 mi	JTEDW21A560[redacted]

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Orig Tracking	
VIN	[redacted]
Doc No.	

Final Destination: CQE	SETR#:		CQE Eng:		

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

	Part #	Part Description	Qty.	VALUE FOR CUSTOMS USE: Used Part Value Each
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,266.9
	Comments:			
2	00272SLLC2	SUPER LONG LIFE COOLANT	1	$ 2.56
	Comments:			
3				$
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Ref	Date
TQCN_FTR-092590051	TMS	QAHybrid	82966466	09/17/2009

Primary Model	Model Year	Production Date	Odometer	VIN	Repair Date
Highlander HV	2006	2005-06-07	30037	JTEEW21A860[redacted]	9/9/2009

Source	Location	Problem Area	Parts Destination	DTC
FTS	REG-NY	Base Vehicle	CQE	p3004/132

Part # 1	Part # 1 Serial/Date Code	Part # 2	Part # 2 Serial/Date Code	Parts Available
G92A048080				Part(s) Available

Condition Title

No Ready On P3004/132 DTC

Condition Description

Customer states vehicle will not Ready On.

Diagnostic Steps

1. Technician verified customer concern vehicle would not Ready On.
2. Vehicle had DTC P3004/132 DTC.
3. Technician checked HV cables for short to ground and no short detected.
4. Technician checked all pin fit to Inverter and HV ECU and NTF
5. Technician checked voltage output to HV relay assembly and found initial battery voltage at CON2 terminal and then voltage would go away.
6. Technician removed HV battery cover and checked voltage at relay and had same condition.
7. Technician replaced HV ECU and HV relay assembly with no change.
8. With help from TAS engineer, Technician took snapshot of Ready On sequence. Found the VL voltage increased to 298v and VH voltage only increased to 183v during pre-charge (see picture and snapshot). HV ECU did not command SMRB to turn On and MIL would set.

Probable Cause

Internal issue with Inverter Assembly

Repair Process

Technician replaced Inverter assembly to resolve concern.

Ready On Sequence.TSE

ready on.jpg

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_FTR-092590051	No Ready On P3004/132 DTC	09/17/2009

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2005-06-07	30037	JTEEW21A860[redacted]

Orig Tracking

VIN [redacted]

Doc No.

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所:
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先: Tel:

T-STAR [redacted] [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each	Serial No. / Date Code	Comments:
1	G92A048080	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,461.80		
2				$		
3				$		
4				$		
5				$		
6				$		
7				$		

DEALERSHIP PRODUCT REPORT

TQCN DOC#	Affiliate	Dept.	Dealer Code	Ref	Date
TQCN_DPR-102040068	**TMS**	QAHybrid	**19026**	A1045942	07/26/2010

Dealer Name	Dealer City	State	Region	Source
KOONS TOYOTA	ANNAPOLIS	MD	CAT	**TECH**

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	23-MAY-05	81769 mi	JTEDW21A360[redacted]

Part # 1:	Part # 2:	Part # 3:	Parts Destination:	Parts Available:	Repair Date
G92A048090			CQE	Available upon request	7/16/2010

Condition Title	Applicable DTC Code(s)
MIL Light "ON " Codes P0A94, P0A7A, and P0A78	P0A7A,P0A94,P0A78

Condition Description

Transmission would not engage.

Diagnostic Steps:

- Attempted to test drive vehicle - it would not move
- Inspected Transaxle fluid level – found it okay
- Inspected Inverter Coolant level – found it low
- Inspected for Coolant leakage - found leak at right inverter hose/found clamp loose
- Inspection found Inverter had overheated and is not functioning properly

Probable Cause

Unknown.

Repair Process

Tightened clamp. Replaced Inverter Assembly/HV Motor Control.

DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_DPR-102040068	MIL Light "ON " Codes P0A94, P0A7A, and P0A78	07/26/2010

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	23-MAY-05	81769 mi	JTEDW21A360[redacted]

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Orig Tracking	
VIN	[redacted]
Doc No.	

Final Destination: CQE	SETR#:		CQE Eng:		

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

	Part # 1:	Part Description	Qty.	VALUE FOR CUSTOMS USE: Used Part Value Each
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,240.38
	Comments:			
2	Part # 2:	Part Description	Qty.	Used Part Value Each $
	Comments:			
3	Part # 3:	Part Description	Qty.	Used Part Value Each $
	Comments:			

DEALERSHIP PRODUCT REPORT

TQCN DOC#	Affiliate	Dept.	Dealer Code	Ref	Date
TQCN_DPR-102020085	**TMS**	QAHybrid	**04159**	A0471417	08/10/2010

Dealer Name	Dealer City	State	Region	Source
SOUTH BAY TOYOTA	GARDENA	CA	LOS	**TECH**

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	08-MAR-06	46736 mi	JTEDW21A860[redacted]

Part # 1:	Part # 2:	Part # 3:	Parts Destination:	Parts Available:	Repair Date
G92A048090			CQE	Available upon request	7/21/2010

Condition Title	Applicable DTC Code(s)
MIL On Vehicle will not “Ready On”.	P0A78/287

Condition Description

- Vehicle will not “Ready On”.

Diagnostic Steps:

- Used Techstream and pulled codes. DTC P0A78/287 is present.

Probable Cause

- Unknown

Repair Process

- Replaced inverter.

zRDMObjectFile.zip

DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_DPR-102020085	MIL On Code P0A78 / 287	08/10/2010

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	08-MAR-06	46736 mi	JTEDW21A860[redacted]

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Orig Tracking	
VIN	[redacted]
Doc No.	

Final Destination: CQE	SETR#:		CQE Eng:		

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

					VALUE FOR CUSTOMS USE:
1	**Part # 1:** G92A048090	**Part Description** INVERTER ASSY, HV MOTOR CONTROL	**Qty.** 1	**Used Part Value Each** $ 1,240.38	
	Comments:				
2	**Part # 2:**	**Part Description**	**Qty.**	**Used Part Value Each** $	
	Comments:				
3	**Part # 3:**	**Part Description**	**Qty.**	**Used Part Value Each** $	
	Comments:				

DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Dealer Code	Ref	Date
TQCN_DPR-102610017	**TMS**	QAPowertrain	**02038**	A2649336	09/21/2010

Dealer Name	Dealer City	State	Region	Source
HATCH TOYOTA	SHOW LOW	AZ	DEN	**TECH**

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	18-AUG-05	112119 mi	JTEDW21A460[redacted]

Part # 1:	Part # 2:	Part # 3:	Parts Destination:	Parts Available:	Repair Date
G92A048090			CQE	Available upon request	9/18/2010

Condition Title	Applicable DTC Code(s)
MIL Light ON Codes P0A78, P0300 and U131	P0A78,U0131,P0300

Condition Description

Check engine light on. Will not go into ready mode.

Diagnostic Steps:

Scan for DTC'S. Trans will not freewheel in neutral. Disconnect high voltage wires to trans at the inverter. Trans will then freewheel.

Probable Cause

Unknown.

Repair Process

Replace the inverter.

DEALERSHIP PRODUCT REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_DPR-102610017	MIL Light ON Codes P0A78, P0300 and U131	09/21/2010

Primary Model	Model Year	Production Date	Odometer	VIN
Highlander HV	2006	18-AUG-05	112119 mi	JTEDW21A460[redacted]

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Orig Tracking	
VIN	[redacted]
Doc No.	

Final Destination: CQE	SETR#:		CQE Eng:		

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所：
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先： Tel:

	Part #	Part Description	Qty.	VALUE FOR CUSTOMS USE: Used Part Value Each
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,240.38
	Comments:			
2	Part # 2:	Part Description	Qty.	Used Part Value Each $
	Comments:			
3	Part # 3:	Part Description	Qty.	Used Part Value Each $
	Comments:			

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Ref	Date
TQCN_FTR-102590114	TMS	QAPowertrain	A2649182	09/21/2010

Primary Model	Model Year	Production Date	Odometer	VIN	Repair Date
Highlander HV	2006	2006-02-28	40283	JTEEW21AX60[redacted]	8/17/2010

Source	Location	Problem Area	Parts Destination	DTC
PE	TMS-PQSS	Base Vehicle	CQE	P0A46/671,P0A47/670

Part # 1	Part # 1 Serial/Date Code	Part # 2	Part # 2 Serial/Date Code	Parts Available
G92A048080				Manual Part Return

Condition Title

MIL "ON" Codes P0A46 info 671 and P0A47 info 670

Condition Description

Customer states MIL On. Technician retrieved P0A46/671 (Drive Motor “B” Position Sensor Circuit Range/Performance) DTC and P0A47/670 (Drive Motor “B” Position Circuit Low) DTC.

Diagnostic Steps

- DTC will reset immediately after clearing.
- Technician tested the MGR Resolver phase circuits for open, short, or inter-phase short. None found.
- Technician verified MGR Resolver phase resistances were within specification.
- Technician inspected EC2 Junction Connector, MGR M9, and Inverter I18 connectors for connection problems. None found.
- Technician replaced the MGR and the DTCs reset IG On.
- Technician replaced the Inverter Assy. and the DTCs would not reset.

Probable Cause

Internal Issue with Inverter MG ECU.

Repair Process

Replaced Inverter Assy to correct.

P0A46.pdf	P0A47.pdf
Freeze Frame Data	Freeze Frame Data

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_FTR-102590114	MIL "ON" Codes P0A46 info 671 and P0A47 info 670	09/21/2010

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2006-02-28	40283	JTEEW21AX60[redacted]

Orig Tracking [redacted]

VIN

Doc No.

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所:
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先: Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each	Serial No. / Date Code	Comments:
1	G92A048080	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,432.81		
2				$		
3				$		
4				$		
5				$		
6				$		
7				$		

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.		Ref	Date
TQCN_FTR-102790108	TMS	QAHybrid		A0340637	10/11/2010
Primary Model	**Model Year**	**Production Date**	**Odometer**	**VIN**	**Repair Date**
Highlander HV	2006	2005-09-30	142267	JTEEW21AX60[redacted]	10/4/2010
Source	**Location**	**Problem Area**	**Parts Destination**	**DTC**	
FPE	TMS-PQSS	Base Vehicle	CQE	P0A7A/325	
Part # 1	**Part # 1 Serial/Date Code**	**Part # 2**	**Part # 2 Serial/Date Code**	**Parts Available**	
G92A048020				Part(s) Available	

Condition Title

MIL ON - DTC P0A7A - High Repair Cost

Condition Description

MIL had illuminated setting DTC P0A7A (Generator Inverter Performance) with Information Code 325 in HV ECU Memory. Vehicle would not Ready On, and was towed to Toyota Dealership for repairs. Vehicle exhibited Inverter malfunction outlined in TSB EG017-06 "M.I.L. "On" DTC P0A7A, Information Code 325" but was not eligible for Warranty Coverage due to time (over 4 Years in Service) and Mileage (142,267 miles) accumulated.

- Component cost for Inverter Assembly PN G92A0-48080 (substitute for G92A0-48020) from Toyota Part System was $5,731.23/Dealer Cost, $8,182.27/Retail Cost. Retail Cost was $8,182.27 + CA Sales Tax (9.25%) for a total of $8,939.13. After Labor Cost of $555.00 was added, total repair cost was $9,494.13.
- Used car Kelley Bluebook value for Vehicle was approx. $12,000.00. Repair Cost for Inverter malfunction was almost equivalent to value of Vehicle.
- Vehicle was owned and operated by a Real-estate Agent who drove Vehicle long distances. Driving pattern was generally 60 % Freeway, 40% City operation.

High cost of Inverter malfunction – related repair prompted the following comments from Customer (Customer Voice):

- Customer was "shocked" that repair cost was so high, especially due to "ridiculously expensive" component price.
- Customer immediately asked what Toyota Warranty coverage would be on New Replacement Inverter Assembly. When told that Warranty was 12 months/Unlimited Mileage, Customers response was "I better get rid of this car before 12 months is up".
- Customer said, "I will never buy another Hybrid Vehicle. I'll buy another Toyota, but not a Hybrid ".

Diagnostic Steps

Technician conducted Healthcheck using Techstream Scan Tool, which revealed DTC P0A7A in Hybrid ECU Self-Diagnostic Memory. Malfunction matched parameters outlined in TSB EG017-06, which eliminated need for further diagnosis.

Probable Cause

MIL on/Inoperative Hybrid System was caused by a malfunctioning Inverter assembly.

Repair Process

Inverter assembly was replaced, correcting condition. Dealer contacted District Service Manager, who authorized 50% coverage for repair cost under Customer Good Will.

- Actual repair cost charged to Customer was $4,817.07 (Part Cost/$4,091.14, Labor/$277.50, CA Sales Tax/$378.43).
- Customer was grateful for assistance from Toyota, but still concerned that 4 year old vehicle required a $4,817.00 repair.

2006 Highlander HV Inverter assembly that set DTC P0A7A, illuminated MIL and rendered Vehicle inoperative.

Close-up photo showing manufactures markings on malfunctioning Inverter assembly. Markings were:
G9200 – 48021
0126YA073

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_FTR-102790108	MIL ON - DTC P0A7A - High Repair Cost	10/11/2010

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2005-09-30	142267	JTEEW21AX60[redacted]

Orig Tracking

VIN [redacted]

Doc No.

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所:
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先: Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each	Serial No. / Date Code	Comments:
1	G92A048020	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,431.51		
2				$		
3				$		
4				$		
5				$		
6				$		
7				$		

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Ref	Date
TQCN_FTR-110250206	TMS	QAHybrid	A0340637	01/31/2011

Primary Model	Model Year	Production Date	Odometer	VIN	Repair Date
Highlander HV	2006	2005-09-27	147938	JTEEW21A560[redacted]	1/17/2011

Source	Location	Problem Area	Parts Destination	DTC
FPE	PQFO-NY	Base Vehicle	CQE	P0A7A

Part # 1	Part # 1 Serial/Date Code	Part # 2	Part # 2 Serial/Date Code	Parts Available
G92A048020				No Part(s) Available

Condition Title

MIL Light "ON" Code P0A7A

Condition Description

Customer states vehicle lost power and warning lights came on. Vehicle will not Ready On.
Vehicle towed in the dealer.
Customer did not hear any noise from vehicle.

TOYOTA TECHNICAL ASSISTANCE SYSTEM
Hybrid Powertrain Pre-Call Worksheet

Dealer Code: 29031 Galaxy Toyota | Technician's Name: S

VIN: 600133991 | P/D: | Mileage: 147938

Complaint Verified: ☒ Yes ☐ No
Accessories: ( ) RSE ( ) Other (aftermarket)

Freeze Frame Data Saved? ☒ Yes ☐ No
* DO NOT CLEAR CODES!!!

Write DTCs below: P0A7A-325

Please ask customer about what happened (how was the vehicle driven when the problem occurred):
Night Time about 45min of travel 60-70mph

How long has customer owned vehicle? New How often does customer drive vehicle? [illegible] (miles per day / week / month)

How long has this condition been present? ☐ Since purchase ☐ Since _____ miles / months

Where did the problem occur? City _____ Intersection _____ Highway Y Other _____

Was the vehicle able to drive after the problem occurred? ☐ Yes ☒ No

If Yes and there was a restriction to drive, please describe: _____

How was vehicle brought to the dealer? ☐ Customer drove in vehicle ☒ Vehicle towed into dealer @ night 1:13 AM

How far was customer from dealer when the problem occurred? 1/13/11 Tow-2 hours / miles

Did customer try to restart vehicle by cycling the IG key or push start switch? ☒ Yes ☐ No

If Yes, how many attempts? Multiple Was system started or did READY ON light appear? ☐ Yes ☐ No

Did warning lights go off? ☒ Yes ☐ No If yes, warning lights went off: ☒ immediately ☐ a few times after IG cycling.

Driving Conditions	Road Conditions	Vehicle Condition		
Vehicle Speed 60-70mph ☐ Accel from Stop ☐ Accel from Cruise ____mph -> ____ mph ☒ Cruise ☐ Decelerating ____mph -> ____ mph ☐ While Braking ☐ While Turning ☐ While Parking ☐ Other, describe:	☒ Flat ☐ Ascent ____° ☐ Descent ____° ☒ Dry Paved ☐ Wet Paved ☐ Unpaved ☐ Rough Paved ☐ Snowy / Frozen ☐ Curb ☐ Other, describe:	Fuel Level: ☐ Just Fueled ☐ Between Full & 3/4 ☐ Between 3/4 & 1/2 ☐ Between 1/2 & 1/4 ☐ Below 1/4 HV Battery Indication: ☐ Full ☐ 3/4 ☐ 1/2 ☐ 1/4 ☐ Below 1/4	☐ While READY ON ☐ After READY ON ☒ Engine Running Shift Selector Lever in: ☐ Park ☐ Reverse ☐ Neutral ☒ Drive ☐ "B" Range ☐ Moving Lever from ____ to ____	Warning Lights Master ☐ ON MIL ☐ ON VSC ☐ ON Charge ☐ ON ABS ☐ ON P/S ☐ ON Battery ☐ ON Hybrid ☐ ON Other warnings:

Did customer drive vehicle immediately before problem occurred? ☒ Yes ☐ No

If yes, How long was the drive before problem occurred? 45 hours / miles Average vehicle speed? 60-70 mph

If no, How long was vehicle stopped or parked? _____ hours / days What was outside temperature? 20 F

Where was car stopped or parked? ☐ Garage ☐ Mall ☐ Traffic signal ☐ other _____

Has the 12V battery been dead or replaced? ☐ Yes, at Toyota Dealer ☐ Yes, at non-Toyota Dealer ☐ No

Noise Conditions

☐ Thunk
☐ Clunk
☐ Clatter
☐ Rattle
☐ Whir
☐ Buzz
☐ Drone
☐ Whine
☐ Other _____

How often is the noise present? ☐ Always ☐ Intermittently ☐ Other _____

Was there an event that triggered the noise? _____

Is the noise affected by drive time? ☐ Noise increases ☐ Noise decreases ☐ No change

Are there any additional description details? _____

Is the noise frequency affected by vehicle speed? ☐ Yes ☐ No

TQCN DOC#	Condition Title			Date
TQCN_FTR-110250206	MIL Light "ON" Code P0A7A			01/31/2011
Primary Model	**Model Year**	**Production Date**	**Odometer**	**VIN (confirm 17 characters):**
Highlander HV	2006	2005-09-27	147938	JTEEW21A560[redacted]

Diagnostic Steps

- Tech tried to Ready On, but vehicle shut off itself in a matter of seconds.
- Tech checked DTC. P0A7A-325 “Generator Inverter Performance”.
- Tech checked TSB EG017-06. The data of FFD did not fit the criteria of TSB.
  Therefore, the technician tried to inspect according to the repair manual.
  But he requested the repair support of FTS and PQFO-NE because he did not have milliohm meter.

Data List Item	Criteria of TSB	Result	Judge
Run Time	< 120 Seconds	< 120 Seconds	Match
MG1 Torque	0 Nm	-80 Nm	Different
MG1 Rev	4000-6000 rpm	0 rpm	Different
SPD	**<= 3 mph**	**74 mph**	Match

- Tech and PQFO-NE members inspected the vehicle as per the Repair Manual.
  1. Confirmed the HV ECU connection condition is Good.
  2. Confirmed the MG ECU connection condition of inside Inverter is Good.
  3. Confirmed the three-phase AC cables connection condition is Good.
     And there are NO arc marks. (Please refer the Picture 1.)

  4. Confirmed the resistance of MG by milliohm meter.

Tester Connection	Result	Specified Condition	Judge
U - V	39.4 mΩ (15℃)	37 to 41 mΩ (20℃)	Good
V - W	37.6 mΩ (15℃)	36 to 40 mΩ (20℃)	Good
W - U	**37.5** mΩ (15℃)	36 to 40 mΩ (20℃)	Good

Difference between the maximum and minimum resistance. **1.9** mΩ ···Judge : Good
Standard resistance: Difference is 5 mΩ or less

  5. Confirmed the resistance of MG by megohm meter.

Tester Connection	Result	Specified Condition	Judge
U terminal - Body ground	Over 2000 MΩ	100 MΩ or higher	Good
U terminal - Shield ground	Over 2000 MΩ	100 MΩ or higher	Good
V terminal - Body ground	Over 2000 MΩ	100 MΩ or higher	Good
V terminal - Shield ground	Over 2000 MΩ	100 MΩ or higher	Good
W terminal - Body ground	Over 2000 MΩ	100 MΩ or higher	Good
W terminal - Shield ground	Over 2000 MΩ	100 MΩ or higher	Good

  6. Measure the voltage of GENERATOR RESOLVER from MG ECU Connecter.

Tester Connection	Result	Specified Condition	Judge
I19-12 (GRF) - Body ground	0 V	Below 1 V	Good
I19-22 (GRFG) - Body ground	0 V	Below 1 V	Good
I19-11 (GSN) - Body ground	0 V	Below 1 V	Good
I19-10 (GSNG) - Body ground	0 V	Below 1V	Good
I19-9 (GCS) - Body ground	0 V	Below 1 V	Good
I19-8 (GCSG) - Body ground	0 V	Below 1 V	Good

TQCN DOC#	Condition Title	Date
TQCN_FTR-110250206	MIL Light "ON" Code P0A7A	01/31/2011

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2005-09-27	147938	JTEEW21A560[redacted]

7. Measure the resistances of GENERATOR RESOLVER from MG ECU Connecter.

Tester Connection	Result	Specified Condition	Judge
I19-12 (GRF) - I19-22 (GRFG)	8.0 Ω	4.2 to 12.5 Ω	Good
I19-11 (GSN) - I19-10 (GSNG)	14.2 Ω	9.8 to 20.1 Ω	Good
I19-9 (GCS) - I19-8 (GCSG)	13.9 Ω	9.8 to 20.1 Ω	Good

Tester Connection	Result	Specified Condition	Judge
I19-12 (GRF) - Body ground	OL (Open)	10 kΩ or higher	Good
I19-22 (GRFG) - Body ground	OL (Open)	10 kΩ or higher	Good
I19-11 (GSN) - Body ground	OL (Open)	10 kΩ or higher	Good
I19-10 (GSNG) - Body ground	OL (Open)	10 kΩ or higher	Good
I19-9 (GCS) – Body ground	OL (Open)	10 kΩ or higher	Good
I19-8 (GCSG) – Body ground	OL (Open)	10 kΩ or higher	Good

8. Check the revolution of Crankshaft Pulley on P Position.
   Tech Confirmed the Crankshaft rotate.

- Tech and PQFO-NE members suspected Inverter internal issue.

Probable Cause

Unknown

Repair Process

Did not repair at this time. Because this vehicle is out of warranty.
Customer decided to buy a new RAV4 due to cost of repair.
Repair cost is about $8500. Parts Cost : $8000. Labor : $500. Retail value of this vehicle :$8000-$10000
If dealer replace inverter, we may be able to recover this inverter.

Vehicle overview

Picture 1

There are NO arc marks.

TQCN DOC#	Condition Title	Date
TQCN_FTR-110250206	MIL Light "ON" Code P0A7A	01/31/2011

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2005-09-27	147938	JTEEW21A560[redacted]

FFD

FFD before clear DTC.pdf

FFD after clear DTC.pdf

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_FTR-110250206	MIL Light "ON" Code P0A7A	01/31/2011

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2005-09-27	147938	JTEEW21A560[redacted]

Orig Tracking

VIN [redacted]

Doc No.

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所:
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先: Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each	Serial No. / Date Code	Comments:
1	G92A048020	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,433.64		
2				$		
3				$		
4				$		
5				$		
6				$		
7				$		

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Ref	Date
TQCN_FTR-110340176	TMS	QAPowertrain	A0340637	02/04/2011

Primary Model	Model Year	Production Date	Odometer	VIN	Repair Date
Highlander HV	2006	2006-01-14	78778	JTEDW21AX60[redacted]	12/27/2010

Source	Location	Problem Area	Parts Destination	DTC
FPE	PQFO-NW	Base Vehicle	CQE	P0A78/287

Part # 1	Part # 1 Serial/Date Code	Part # 2	Part # 2 Serial/Date Code	Parts Available
G92A048090				Part(s) Available

Condition Title

MIL ON DTC P0A78 - High Repair Cost

Condition Description

MIL had illuminated setting DTC P0A78 (Drive Motor "A" Inverter Performance) with Information Code 287 in HV ECU Memory. Vehicle would not Ready On, and was towed to Toyota Dealership for Inverter-related repairs. Component cost for Inverter Assembly from Toyota Part System was $4,960.69/Dealer Cost, $7,083.37/Retail Cost. Total cost of repair was $7,426.37.

- Used car Kelley Bluebook Trade-in (Wholesale) value for Vehicle (Highlander HV 4x2) was approx. $16,700.00. Repair Cost for Inverter malfunction was almost equivalent to 45% of Vehicle's Trade-in value.
- Vehicle was owned and operated by a housewife. Driving pattern was generally 80% City, 20 % Freeway operation.
- High cost of repair prompted customer to comment (Customer Voice) She was glad repairs were still covered by Toyota Warranty.
- Vehicle exhibited concern outlined in T-SB-0386-08 "M.I.L. "On" DTC P0A78 with Information Code 286, 287" and was still eligible for Hybrid Component Warranty Coverage with less than 8 years or 100,000 miles accumulated.

Diagnostic Steps

Technician conducted Healthcheck using Techstream Scan Tool, which revealed DTC P0A78 in Hybrid ECU Self-Diagnostic Memory. Criteria matched parameters outlined in T-SB-0386-08, which eliminated need for further diagnosis. Attached is a PDF copy of TSB:

T-SB-0386-08.pdf

Probable Cause

MIL on/Inoperative Hybrid System was caused by the Inverter assembly

Repair Process

Inverter assembly was replaced, correcting condition.

2006 Highlander HV Inverter assembly that set DTC P0A78, illuminated MIL and rendered Vehicle inoperative.

Close-up photo showing manufactures markings on Inverter assembly. Markings were:
G9200 – 48011
PA10YA012

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_FTR-110340176	MIL ON DTC P0A78 - High Repair Cost	02/04/2011

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2006-01-14	78778	JTEDW21AX60[redacted]

Orig Tracking

VIN

Doc No.

[redacted]

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所:
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先: Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each	Serial No. / Date Code	Comments:
1	G92A048090	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,240.17		
2				$		
3				$		
4				$		
5				$		
6				$		
7				$		

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Affiliate	Dept.	Ref	Date
TQCN_FTR-110730183	TMS	QAPowertrain	A0340637	03/14/2011

Primary Model	Model Year	Production Date	Odometer	VIN	Repair Date
Highlander HV	2006	2006-02-23	111985	JTEDW21A260[redacted]	3/9/2011

Source	Location	Problem Area	Parts Destination	DTC
FTS	REG-LA	Base Vehicle	CQE	C1259

Part # 1	Part # 1 Serial/Date Code	Part # 2	Part # 2 Serial/Date Code	Parts Available
G92A048010				Part(s) Available

Condition Title

MIL Light "ON" Codes P0A78/284,510 and P0A90/509

Condition Description

Customer states that the MIL illuminated and vehicle won't start

Diagnostic Steps

- Cleared codes and drove vehicle at 2 MPH for 15 seconds
- Heard clunking noise from transaxle
- Techstream would not communicate with HV ECU
- HV fuse is open
- Unplugged Inverter and HV fuse does not go open

Probable Cause

Unknown

Repair Process

Goodwill replacement of the Inverter

C:¥Documents and Settings¥davidss¥Des	Techstream file of vehicle

FIELD TECHNICAL REPORT

TOYOTA | LEXUS

TQCN DOC#	Condition Title	Date
TQCN_FTR-110730183	MIL Light "ON" Codes P0A78/284,510 and P0A90/509	03/14/2011

Primary Model	Model Year	Production Date	Odometer	VIN (confirm 17 characters):
Highlander HV	2006	2006-02-23	111985	JTEDW21A260[redacted]

Orig Tracking

VIN [redacted]

Doc No.

Attachment 1: **Parts Recovery Control Sheet**

Do not type in SHADED fields. If the **Final Destination** field below is "**scrap**", properly dispose of the part.

Final Destination:	CQE	SETR#:		CQE Eng:	N/A	

Importer: (Applies to TMC Shipments Only)	Deliver to:	住所:
Mr. N. Okumura, Chief Expert Quality Div. Warranty Parts Room TOYOTA MOTOR CORPORATION 1 Toyota, Toyota-city, Aichi, 471-8571 Japan	Attn: Tel:	宛先: Tel:

T-STAR [redacted]

Note: If this FTR contains more than one VIN, create a table in the report containing VIN, production date, and odometer

FOR CUSTOMS USE: Used Parts Value

	Part #	Part Description	Qty.	Used Part Value Each	Serial No. / Date Code	Comments:
1	G92A048010	INVERTER ASSY, HV MOTOR CONTROL	1	$ 1,240.09		
2				$		
3				$		
4				$		
5				$		
6				$		
7				$		

PE11-005

TOYOTA

4/29/2011

ATTACHMENT 6, Extended Warranty Option

TOYOTA
FINANCIAL SERVICES

Toyota Reference Guide

Vehicle Service Agreements

Toyota Extra Care – **Platinum, Gold and Powertrain**

	Platinum — NEW Plans	**Platinum** — USED Plans	**Gold** — NEW Plans	**Gold** — USED Plans	**Powertrain** — NEW Plans	**Powertrain** — USED Plans
Qualifying Criteria	Vehicles are eligible for a "New Vehicle" VSA for 3 years or 36,000 miles, whichever comes first. Time is effective from date of first use. Mileage is effective at zero.	Vehicles qualify if within current plus 9 model years and less than 125,000 miles. Used vehicle plans must be purchased at the time of used vehicle sale ONLY.	Vehicles are eligible for a "New Vehicle" VSA for 3 years or 36,000 miles, whichever comes first. Time is effective from date of first use. Mileage is effective at zero.	Vehicles qualify if within current plus 9 model years and less than 125,000 miles. Used vehicle plans must be purchased at the time of used vehicle sale ONLY.	Vehicles are eligible for a "New Vehicle" VSA for 3 years or 36,000 miles, whichever comes first. Time is effective from date of first use. Mileage is effective at zero.	Vehicles qualify if within current plus 12 model years and less than 100,000 miles. Used vehicle plans must be purchased at the time of used vehicle sale ONLY.
Plans Offered *See Rate Binder for details.* VSA expires at expiration mileage or date, whichever comes first.	**Years/** Miles **3 years/** 50,000, 80,000 miles **4 years/** 65,000, 100,000, 125,000 miles **5 years/** 60,000, 80,000, 100,000, 125,000 miles **6 years/** 75,000, 100,000, 125,000 miles **7 years/** 75,000, 100,000, 125,000 miles **8 years/** 75,000, 100,000, 125,000 miles	**Plan Term – Mileage*** Max. Mileage at Purchase **1 year – 12,000** 30,000, 50,000, 70,000, 85,000, 100,000, 125,000 miles **2 years – 24,000** 30,000, 50,000, 70,000, 85,000, 100,000 miles **3 years – 36,000** 30,000, 50,000, 70,000, 85,000, 100,000 miles **4 years – 50,000** 30,000, 50,000, 70,000, 85,000, 100,000 miles **5 years – 60,000** 30,000, 50,000, 70,000, 85,000 miles	**Years/** Miles **3 years/** 50,000, 80,000 miles **4 years/** 65,000, 100,000, 125,000 miles **5 years/** 60,000, 80,000, 100,000, 125,000 miles **6 years/** 75,000, 100,000, 125,000 miles **7 years/** 75,000, 100,000, 125,000 miles **8 years/** 75,000, 100,000, 125,000 miles	**Plan Term – Mileage*** Max. Mileage at Purchase **1 year – 12,000** 30,000, 50,000, 70,000, 85,000, 100,000, 125,000 miles **2 years – 24,000** 30,000, 50,000, 70,000, 85,000, 100,000 miles **3 years – 36,000** 30,000, 50,000, 70,000, 85,000, 100,000 miles **4 years – 50,000** 30,000, 50,000, 70,000, 85,000, 100,000 miles **5 years – 60,000** 30,000, 50,000, 70,000, 85,000 miles	**Years/** Miles **6 years/** 100,000 miles	**Plan Term – Mileage*** Max. Mileage at Purchase **1 year – 12,000** 30,000, 50,000, 70,000, 85,000, 100,000 miles **2 years – 24,000** 30,000, 50,000, 70,000, 85,000, 100,000 miles
Towing Benefits**	Unlimited towing reimbursement to the nearest dealership or authorized repair facility	Unlimited towing reimbursement to the nearest dealership or authorized repair facility	Up to $50 per occurrence	Up to $50 per occurrence	Up to $50 per occurrence	Up to $50 per occurrence
Substitute Transportation** *Requires prior approval of Administrator.*	Up to $50 per day for a maximum of 5 days per occurrence	Up to $50 per day for a maximum of 5 days per occurrence	Up to $35 per day for a maximum of 5 days per occurrence	Up to $35 per day for a maximum of 5 days per occurrence	Up to $35 per day for a maximum of 5 days per occurrence	Up to $35 per day for a maximum of 5 days per occurrence
Travel Protection Benefits: Lodging and Meals** Must be more than 150 miles from home. *Requires prior approval of Administrator.*	Up to $100 per day for a maximum of 5 days over the life of the Agreement	Up to $100 per day for a maximum of 5 days over the life of the Agreement	Up to $50 per day for a maximum of 4 days over the life of the Agreement	None	Up to $50 per day for a maximum of 4 days over the life of the Agreement	None
Deductible Options*** Depending on selected plan.	$0 or $50 per eligible repair visit	$0 or $50 per eligible repair visit	$0 or $50 per eligible repair visit	$0 or $50 per eligible repair visit	$0 or $50 per eligible repair visit	$0 or $50 per eligible repair visit
Transferability Between private parties only. Excludes Retail Outlets.	Transferable one time, from the original new car owner to the next owner, for a $50 processing fee.	Transferable one time, from the original used car owner to the next owner, for a $50 processing fee.	Transferable one time, from the original new car owner to the next owner, for a $50 processing fee.	Transferable one time, from the original used car owner to the next owner, for a $50 processing fee.	Transferable one time, from the original new car owner to the next owner, for a $50 processing fee.	Transferable one time, from the original used car owner to the next owner, for a $50 processing fee.
Cancellation Please refer to actual Vehicle Service Agreement contract for state-specific policy.	Within 30 days, full refund less a $25 processing fee. Pro-rata refund beyond 30 days, or if benefits have been paid. (Joint payee if release of lien is not attached).	Within 30 days, full refund less a $25 processing fee. Pro-rata refund beyond 30 days, or if benefits have been paid. (Joint payee if release of lien is not attached).	Within 30 days, full refund less a $25 processing fee. Pro-rata refund beyond 30 days, or if benefits have been paid. (Joint payee if release of lien is not attached).	Within 30 days, full refund less a $25 processing fee. Pro-rata refund beyond 30 days, or if benefits have been paid. (Joint payee if release of lien is not attached).	Within 30 days, full refund less a $25 processing fee. Pro-rata refund beyond 30 days, or if benefits have been paid. (Joint payee if release of lien is not attached).	Within 30 days, full refund less a $25 processing fee. Pro-rata refund beyond 30 days, or if benefits have been paid. (Joint payee if release of lien is not attached).

Coverage is subject to exclusions and limitations set forth in the Vehicle Service Agreement.
Note: The benefits and covered operations stated here are subject to change or may vary slightly based upon the purchase date of the Agreement.

* Coverage expires upon reaching your selected time or mileage of the coverage period, whichever occurs first.
** Available if vehicle is inoperable due to the mechanical failure of a covered component. Valid receipts will be required for reimbursement.
*** Plans feature $0 or $50 deductible options. Deductible applies to each eligible repair visit.

Toyota Certified Used Vehicles

	Toyota Certified Used Vehicle Warranty		Toyota Certified Vehicle Service Agreement	
	Limited Powertrain Warranty	Comprehensive Warranty	Platinum	Gold
Qualifying Criteria	Vehicles that are of current plus 6 model years old and with less than 85,000 total vehicle miles and meet the requirements of Certification established by Toyota.	Vehicles that are of current plus 6 model years old and with less than 85,000 total vehicle miles and meet the requirements of Certification established by Toyota.	Vehicle must have a Toyota Certified Used Vehicle Limited Powertrain Warranty and be a Toyota Certified Used Vehicle to be eligible for the Toyota Certified Used Vehicle Service Agreement. Available at the time of Toyota Certified Used Vehicle purchase ONLY.	Vehicle must have a Toyota Certified Used Vehicle Limited Powertrain Warranty and be a Toyota Certified Used Vehicle to be eligible for the Toyota Certified Vehicle Service Agreement. Available at the time of Toyota Certified Used Vehicle purchase ONLY.
Plans Offered* *See Rates and Reference Guide for details.*	Certified Used Vehicle Limited Powertrain Warranty provided by Toyota. Coverage effective until 7 years after vehicle's date of first use as a new vehicle or 100,000 total vehicle miles, whichever occurs first.	Certified Comprehensive Warranty provided by Toyota. Coverage effective for 12 months or 12,000 miles from date of purchase of the Certified Used Vehicle, whichever occurs first.	Plan Options: 7 years / 100,000 miles 7 years / 125,000 miles 8 years / 100,000 miles 8 years / 125,000 miles Coverage effective as of vehicle's date of first use as a new vehicle.*	Coverage effective until 7 years after vehicle's date of first use as a new vehicle or 100,000 total vehicle miles, whichever occurs first.
Roadside Assistance *Includes towing, flat tire, lockout, jump start and fuel delivery services (up to 3 gallons). Ask customers to call 1-800-297-0486 24 hours a day, 365 days a year within the US and Canada.*	Roadside Assistance is provided for 1 year from the date of Certified Used Vehicle purchase, whichever comes first.	Provided under Certified Limited Powertrain Warranty.	Coverage is effective throughout the life of the Agreement.	Coverage is effective throughout the life of the Agreement.
Towing Benefits	Beyond the Roadside Assistance period, towing to the nearest Toyota dealership is provided for covered repairs at $50 per occurrence.** Coverage effective until 7 years after vehicle's date of first use as a new vehicle or 100,000 total vehicle miles, whichever occurs first.	Towing provided under Certified Limited Powertrain Warranty.	Towing to the nearest Toyota dealership.	Towing to the nearest Toyota dealership.
Substitute Transportation** *Requires prior approval of Administrator.*	Up to $35 per day for a maximum of 5 days per occurrence.	Up to $50 per day for a maximum of 5 days per occurrence.	Up to $50 per day for a maximum of 5 days per occurrence.	Up to $35 per day for a maximum of 5 days per occurrence.
Travel Protection Benefits: Lodging and Meals** Must be more than 150 miles from home. *Requires prior approval of Administrator.*	Up to $50 per day for a maximum of 4 days over the life of the Agreement.	Up to $100 per day for a maximum of 5 days over the life of the Agreement.	Up to $100 per day for a maximum of 5 days over the life of the Agreement.	Up to $50 per day for a maximum of 4 days over the life of the Agreement.
Deductible Options*** Depending on selected plan.	$50 per eligible repair visit. Deductible is waived under Platinum plan.	$50 per eligible repair visit. Deductible is waived under Platinum plan.	$0 per eligible repair visit.	$50 per eligible repair visit.
Transferability Between private parties only. Excludes Retail Outlets.	Toyota Certified Used Vehicle Limited Powertrain Warranty transfers with the vehicle until Warranty expiration. See the Toyota Certified Policies and Procedures Manual for specific details.	Non-transferable.	Transferable one time, from the original used car owner to the next owner, for a $50 processing fee.	Transferable one time, from the original used car owner to the next owner, for a $50 processing fee.
Cancellation Please refer to actual Vehicle Service Agreement contract for state-specific policy.	Toyota Certified Used Vehicle Limited Powertrain Warranty can be cancelled (called an "Unwind") by the dealer only. The dealer must receive approval from Toyota. If cancellation is within 90 days and no claims have been paid, the dealer receives a full refund, less a $25 processing fee. Please contact your Regional Toyota Certified Used Vehicle Manager for details.	Toyota Certified Used Vehicle Comprehensive Warranty can be cancelled (called an "Unwind") by the dealer only. The dealer must receive approval from Toyota. If cancellation is within 90 days and no claims have been paid, the dealer receives a full refund, less a $25 processing fee. Please contact your Regional Toyota Certified Used Vehicle Manager for details.	Within 30 days, full refund less $25 processing fee. Pro-rata refund beyond 30 days, or if benefits have been paid. (Joint payee if release of lien is not attached). Please refer to actual Vehicle Service Agreement contract for state-specific policy.	Within 30 days, full refund less $25 processing fee. Pro-rata refund beyond 30 days, or if benefits have been paid. (Joint payee if release of lien is not attached). Please refer to actual Vehicle Service Agreement contract for state-specific policy.

Coverage is subject to exclusions and limitations set forth in the Vehicle Service Agreement.

Note: The benefits and covered operations stated here are subject to change or may vary slightly based upon the purchase date of the Agreement.

* Coverage expires upon reaching your selected time or mileage of the coverage period, whichever occurs first.

** Available if vehicle is inoperable due to the mechanical failure of a covered component. Valid receipts required for reimbursement.

*** Plans feature $0 or $50 deductible options. Deductible applies to each eligible repair visit.

COMPONENTS

The components listed on these pages are examples of those covered under the TFS VSA Plans, the Toyota Certified Used Vehicle (TCUV) Comprehensive Warranty and TCUV Limited Powertrain Warranty.

Description	Platinum/ Certified Platinum/TCUV Comprehensive Warranty	Gold/ Certified Gold	Powertrain/ TCUV Ltd. Powertrain Warranty
AIR CONDITIONING / HEATING			
Air Conditioning Lines and Tubes	•	•	
Air Conditioning Pressure Switches	•	•	
Air Temperature Control Programmer	•	•	
Blower Motor	•	•	
Blower Motor Resistor	•	•	
Compressor	•	•	
Compressor Clutch Assembly	•	•	
Compressor Pulley	•	•	
Condenser	•	•	
Condenser Fan and Motor	•	•	
Cooler Control Switch	•		
Cooler Unit	•		
Damper Servo	•		
Defroster Control Cable	•		
Evaporator	•	•	
Evaporator Temperature Sensor	•	•	
Expansion Valve	•	•	
Heater Control Head	•		
Heater Control Valve	•	•	
Heater Core	•	•	
Idler Pulley	•	•	
Pressure Regulator Assembly	•	•	
Receiver/Dryer	•	•	
Schrader Valve	•	•	
Seals and Gaskets	•	•	
AUTOMATIC TRANSMISSION*			
Transfer Case Components (ALL internally lubricated components) and:			
Hoses, Lines and Tubes	•	•	•
Seals and Gaskets	•	•	•
Shift Lever Knob	•		
Shift Linkage and Cables	•	•	•
Solenoids	•	•	•
Torque Converter	•	•	•
Transfer/Transmission Case	•	•	•
Transmission Mounts	•	•	•
Vacuum Modulator	•	•	•
AXLE ASSEMBLY*			
(Front, Rear, Four-Wheel, and All-Wheel Drive): ALL internally lubricated components and:			
4x4 Actuators	•	•	•
Axles and Bearings	•	•	•
Center Support Bearing	•	•	•
Constant Velocity Joints and Boots	•	•	•
Differential Carrier Assembly	•		
Drive Axle Housing	•	•	•
Drive Shaft	•	•	•
Hubs	•	•	•
Locking Hubs	•	•	•
Seals and Gaskets	•	•	•
Thrust Washers	•	•	•
Universal Joints	•	•	•
Viscous Coupling	•	•	•

Description	Platinum/ Certified Platinum/TCUV Comprehensive Warranty	Gold/ Certified Gold	Powertrain/ TCUV Ltd. Powertrain Warranty
BRAKES			
Anti-Lock Braking/Traction Control Actuator, Pump and Motor	•	•	
Brake Booster	•	•	
Brake Hoses, Lines and Tubes	•	•	
Brake Pedal Subassembly	•		
Disc Brake Calipers	•	•	
Load-Sensing Proportioning Valve	•	•	
Master Cylinder	•	•	
Parking Brake Cable	•	•	
Parking Brake Control Handle Assembly	•		
Parking Brake Lever Subassembly	•		
Parking Brake Pedal Subassembly	•		
Proportioning Valve	•	•	
Rear Brake Backing Plate	•		
Seals and Gaskets	•	•	
Wheel Cylinders	•	•	
COMPUTERS AND ELECTRONICS			
Airbag Sensors	•		
Antenna Cord	•		
Anti-Lock Braking/Traction Control Computer and Sensors	•	•	
Automatic Shoulder Belt Computer	•	•	
Body Control Module	•	•	
Circuit Opening Relay	•		
Compact Disc (CD) Player	•		
Cruise Control Computer	•	•	
Driver's Side and Passenger's Side Airbags	•		
Electronic Ignition Unit	•	•	
Electronically Controlled Transmission/ Transfer Case Computer and Sensors	•	•	
Electronically Modulated Suspension Computer	•	•	
Engine Control Computer**	•	•	•
Front Seat Airbag Assembly	•		
Graphic Equalizer	•		
Knock Sensor	•	•	
Navigation System	•		
Power Mirror Electronic Control Unit	•	•	
Power Seat Computer	•	•	
Progressive Power Steering Computer	•	•	
Radio Tuner	•		
Side Impact Airbag	•		
Steering Sensor	•		
Stereo Component Amplifier	•		
Sunroof Control Computer and Relay	•	•	
Tape Player	•		
Tilt/Telescoping Steering Computer	•	•	
Traction Control Computer	•		
Trip Computer	•	•	
Variable Induction System	•		
Vehicle Security Computers and Sensor	•	•	
Wiper Module	•	•	

Exact determination of coverage will be made by the Administrator. For questions, please call toll free: 1-800-228-8559.

* For Toyota Certified Used Vehicles, Axle Assembly, Automatic Transmission, Manual Transmission and Engine Components are covered under the Toyota Certified Used Vehicle Limited Powertrain Warranty.

** Fuel Pump and Engine Control Computer for hybrid vehicles are covered under the Toyota Certified Used Vehicle Limited Powertrain Warranty, not the Certified VSAs.

Description	Platinum/ Certified Platinum/TCUV Comprehensive Warranty	Gold/ Certified Gold	Powertrain/ TCUV Ltd. Powertrain Warranty
COOLING SYSTEM			
Coolant Level Sensor/Tank	•		
Cooling Fan Relay	•	•	
Cooling Fan Sensor	•	•	
Engine Coolant Temperature Switch or Sensor (at radiator)	•		
Engine Cooling Fan Motor	•	•	
Engine Fan	•	•	
Engine Fan Clutch	•	•	
Engine Fan Motor	•	•	
Engine Fan Shroud	•	•	
Equipment Drive Pulley	•		
Fan Bracket Subassembly	•	•	
Radiator	•	•	
Radiator Fan Relay	•		
Seals and Gaskets	•	•	
Thermostat	•		
ELECTRICAL			
Alternator	•	•	
Automatic-Off Headlamp Sensor, Timer and Switches	•	•	
Automatic Shoulder Belt Motor and Switches	•	•	
Automatic Temperature Control Unit	•	•	
Back-up Light Switch	•		
Battery to Ground Cable	•		
Battery to Starter Cable	•		
Blower Motor	•	•	
Blower Motor Resistor	•	•	
Charge Warning Relay	•		
Clutch Starter Interlock Switch	•	•	
Convertible Top Motor	•	•	
Cruise Control Actuator/Servo	•	•	
Cruise Control Sensors and Switches	•	•	
Cruise Control Vacuum Motor	•	•	
Defogger Relay	•	•	
Distributor	•	•	
Door Control Relay	•		
Engine Coolant Temperature Gauge and Sending Unit	•		
Engine Coolant Temperature Receiver Gauge and Sending Unit	•		
Engine Cooling Fan Motor	•	•	
Engine Tachometer	•		
Fuel Gauge and Sending Unit	•		
Fuel Receiver Gauge and Sending Unit	•		
Guide Rail Limit Switch	•		
Headlamp Washer	•	•	
Headlight Control Relay	•		
Horn	•		
Horn (for theft deterrent)	•		
Ignition Coil	•	•	
Ignition Switch Lock Cylinder and Key Set	•		

Description	Platinum/ Certified Platinum/TCUV Comprehensive Warranty	Gold/ Certified Gold	Powertrain/ TCUV Ltd. Powertrain Warranty
ELECTRICAL *(continued)*			
Integration Relay	•		
Lamp Failure Indicator Sensor	•	•	
License Plate Light Assembly	•		
Lock Cylinder Set	•		
Main Relay	•		
Manually Operated Switches	•	•	
Oil Pressure Receiver Gauge and Sending Unit	•		
Power Antenna Motor and Cable	•	•	
Power Door Lock Actuator	•	•	
Power Mirror Defogger	•	•	
Power Mirror Motor	•	•	
Power Seat Motors	•	•	
Power Sliding Door Motor	•	•	
Power Window Motor/Regulator	•	•	
Rear Shock Absorber Control Actuator	•		
Retractable Headlamp Motor	•	•	
Shoulder Belt Drive Motor	•		
Smart Entry and Start System Switch, Sensor and Electronic Control Unit	•	•	
Spark Plug Resistive Cord	•		
Speedometer	•		
Starter Motor	•	•	
Starter Solenoid	•	•	
Stop Light Switch	•	•	
Sunroof Cables	•		
Sunroof Motor	•	•	
Taillight Control Relay	•		
Turn Signal Flasher	•		
Unlock Warning Buzzer	•		
Windshield Washer Pump	•	•	
Windshield Wiper Link Assembly	•		
Wiper Control Relay	•		
Wiper Motor	•		
Wiring Harnesses	•		
ENGINE			
ALL internally lubricated components and:			
Air Control Valve (ACV)	•		
Air Pump	•		
Balance Shaft	•	•	•
Belt Tensioner	•		
Camshaft	•	•	•
Crankcase Ventilation Valve	•		
Crankshaft	•	•	•
Crankshaft Pulley	•	•	•
Cylinder Heads	•	•	•
Engine Block	•	•	•
Engine Mounts	•	•	•

Exact determination of coverage will be made by the Administrator. For questions, please call toll free: 1-800-228-8559.

* For Toyota Certified Used Vehicles, Axle Assembly, Automatic Transmission, Manual Transmission and Engine Components are covered under the Toyota Certified Used Vehicle Limited Powertrain Warranty.

COMPONENTS

The components listed on these pages are examples of those covered under the TFS VSA Plans, the Toyota Certified Used Vehicle (TCUV) Comprehensive Warranty and TCUV Limited Powertrain Warranty.

Description	Platinum/ Certified Platinum/TCUV Comprehensive Warranty	Gold/ Certified Gold	Powertrain/ TCUV Ltd. Powertrain Warranty
ENGINE *(Continued)*			
Engine Oil Reservoir	•	•	•
Engine Oil Reservoir Pump	•	•	•
Equipment Drive Shaft	•	•	•
Exhaust Gas Recirculation Valve	•		
Exhaust Manifolds	•	•	•
Exhaust Manifold Heat Insulator	•		
Exhaust Pipe Gasket	•		
Flexplate	•	•	•
Flywheel	•	•	•
Idler Pulley	•	•	•
Intake Air Control Valve (IACV)	•		
Intake Manifold	•	•	•
Mixture Control Valve	•		
Oil Cooler	•		
Oil Filter Bracket Subassembly	•		
Oil Pan	•	•	•
Oil Pressure Switch	•	•	•
Oil Pump	•	•	•
Oil Sending Unit	•	•	•
Pair Valve (Reed Valve)	•		
Piston	•	•	•
Seals and Gaskets	•	•	•
Supercharger	•	•	•
Supercharger Bypass Valve	•		
Supercharger Intercooler	•	•	•
Supercharger Relay	•		
Tensioners	•	•	•
Thermal Vacuum Valve	•		
Thermostatic Valve	•		
Three-way Catalyst Converter	•		
Timing Belt	•	•	•
Timing Belt Idler	•		
Timing Chain	•	•	•
Timing Cover	•	•	•
Timing Gears	•	•	•
Turbo Intercooler	•	•	•
Turbo Wastegate	•	•	•
Turbocharger	•	•	•
Vacuum Switch	•		
Vacuum Switching Valve	•		
Vacuum Transmitting Valve	•		
Valve Covers	•	•	•
Water Pump	•	•	•

Description	Platinum/ Certified Platinum/TCUV Comprehensive Warranty	Gold/ Certified Gold	Powertrain/ TCUV Ltd. Powertrain Warranty
FUEL SYSTEM			
Air Flow Meter	•	•	
Carburetor	•	•	
Charcoal Canister	•		
Diesel Fuel Injection Pump	•	•	
Electric Fuel Pump	•	•	
Electronic Fuel Injection System	•	•	
Fuel Filler Opening Lid Hinge Spring	•		
Fuel Injectors	•	•	
Fuel Pressure Regulator	•	•	
Fuel Pump**	•	•	
Fuel Sending Unit	•	•	
Fuel Sensors	•	•	
Fuel Tank	•	•	
Throttle Body	•	•	
HYBRID			
Actuator Assembly Shift Control	•	•	
Battery Computer Assembly	•	•	
Battery Current Sensor	•	•	
Circuit Breaker Sensor	•	•	
Combination Meter Assembly	•	•	
Combination Meter Computer	•	•	
Engine Control Computer	•	•	
Hybrid Vehicle Battery Blower Assembly	•	•	
Hybrid Vehicle Battery Blower Motor Control	•	•	
Hybrid Vehicle Battery Thermistor	•	•	
Hybrid Vehicle Control Computer	•	•	
Hybrid Vehicle Generator Assembly	•	•	•
Hybrid Vehicle Motor Assembly	•	•	•
Hybrid Vehicle Transaxle Assembly	•	•	•
Inverter Assembly With Converter	•	•	
Main Switch Assembly	•	•	
Power Source Control	•	•	
Computer Assembly	•		
Power Steering Electronic Control Unit Assembly	•	•	
Power Steering Gear Assembly	•	•	
Shift Lever Position Sensor	•	•	
Skid Control Computer Assembly	•	•	
Steering Column Assembly	•	•	
Transmission Control Module	•	•	
Transmission Input Damper Assembly	•	•	•

Exact determination of coverage will be made by the Administrator. For questions, please call toll free: 1-800-228-8559.

* For Toyota Certified Used Vehicles, Axle Assembly, Automatic Transmission, Manual Transmission and Engine Components are covered under the Toyota Certified Used Vehicle Limited Powertrain Warranty.

** Fuel Pump and Engine Control Computer for hybrid vehicles are covered under the Toyota Certified Used Vehicle Limited Powertrain Warranty, not the Certified VSAs.

Description	Platinum/ Certified Platinum/TCUV Comprehensive Warranty	Gold/ Certified Gold	Powertrain/ TCUV Ltd. Powertrain Warranty
MANUAL TRANSMISSION			
Transfer Case Components (ALL internally lubricated components) and:			
Clutch Master Cylinder	•	•	•
Clutch Pedal Subassembly	•		
Clutch Release Cylinder	•	•	•
Control Position Indicator Subassembly	•		
Gears and Shafts	•	•	•
Hoses, Lines and Tubes	•	•	•
Master Cylinder Reservoir	•		
Radial Ball Bearing (for Clutch Release) and/or Clutch Fork	•		
Seals and Gaskets	•	•	•
Shift Lever Boot and/or Retainer	•		
Shift Lever Knob	•		
Shift Lever Subassembly	•		
Shift Linkage and Cables	•	•	•
Transfer/Transmission Case	•	•	•
Transmission Mounts	•	•	•
STEERING			
Gear Box internal components and:			
Bushings/Bearings	•	•	
Center Link	•	•	
Horn Contact Ring	•		
Hoses, Lines, and Tubes	•	•	
Idler Arm	•	•	
Knuckle Stopper Cover	•		
Pitman Arm	•	•	
Power Steering Pump	•	•	
Power Steering Pump Pulley	•		
Rack and Pinion	•	•	
Seals and Gaskets	•	•	
Steering Column	•	•	
Steering Column Coupling	•	•	
Steering Column Shaft	•	•	
Steering Dampener	•	•	
Steering Gear Box and Pump Housings	•	•	
Tie Rod End	•	•	
SUSPENSION			
(Front and Rear):			
Bushings/Bearings	•	•	
Control Arm Shafts	•	•	
Electronic Suspension Actuator/Motor and Compressor	•	•	
Front and Rear Coil Springs	•		
Front and Rear Stabilizer Bar	•		
Front Leading Arm	•		
Front Spring Assembly	•		
Front Spring Shackle	•		
Radius Arm	•	•	
Spindle	•	•	
Spindle Support	•	•	
Steering Knuckle	•	•	

Description	Platinum/ Certified Platinum/TCUV Comprehensive Warranty	Gold/ Certified Gold	Powertrain/ TCUV Ltd. Powertrain Warranty
SUSPENSION *(Continued)*			
Strut Rod	•		
Sway Bar Link	•	•	
Torsion Bar Spring	•		
Upper and Lower Ball Joints	•	•	
Upper and Lower Control Arms	•	•	
Upper Arm Shaft	•		
ADDITIONAL COMPONENTS			
Accelerator Pedal and/or Bracket Subassembly	•		
Accelerator Pedal Rod Assembly	•		
Back Door Lock Assembly	•		
Convertible Roof Hook	•		
Door Lock Cylinder	•		
Front and Rear Door Lock Assembly	•		
Front Seat Belt	•		
Glove Compartment Door Lock Cylinder	•		
Glove Compartment Door Latch Subassembly	•		
Hood Lock Assembly	•		
Hood Lock Control Cable Assembly	•		
Hood Support Assembly	•		
Rear Seat Belt	•		
Reclining Seat Back Adjuster	•		
Removable Roof Lock Handle	•		
Seat Track Assembly	•		
Shoulder Belt Guide Rail Assembly	•		
Sliding Roof Drive Cable	•		
Sliding Roof Guide Rail	•		
Tail Gate Lock Assembly	•		
Tilt Roof Lock Handle Assembly	•		

Exact determination of coverage will be made by the Administrator. For questions, please call toll free: 1-800-228-8559.

* For Toyota Certified Used Vehicles, Axle Assembly, Automatic Transmission, Manual Transmission and Engine Components are covered under the Toyota Certified Used Vehicle Limited Powertrain Warranty.

** Fuel Pump and Engine Control Computer for hybrid vehicles are covered under the Toyota Certified Used Vehicle Limited Powertrain Warranty, not the Certified VSAs.

Toyota Extra Care **VSA Service Coverage**

Claim Information 1-800-228-8559

Prior approval is required for all Toyota Financial Services (TFS) Vehicle Service Agreements and Toyota Certified Used Vehicle Limited Powertrain Warranty claims.

Follow the steps outlined below for prior claim authorization:

1. Check Vehicle

Diagnose the vehicle's malfunction.

2. Verify Coverage

Call Toyota Financial Services for Claim Authorization and Agreement verification at:

Toyota Financial Services	1-800-228-8559
Monday – Friday	7am – 7pm Central Time
Saturday	8am – 1pm Central Time

a. Verify the VIN on the VSA or Certified Warranty matches the vehicle's VIN.
b. Verify that the owner of the vehicle is also the owner of the VSA or Certified Warranty, as coverage will only apply to the owner.
c. Verify with TFS that the Agreement is active.
d. Verify with TFS that the odometer reads less than the Agreement expiration mileage.
e. Verify coverage for the component requiring replacement or repair.
f. Obtain and record the authorization number given by the Claims Operations Specialist on the Repair Order.

3. Complete Repair

a. After verification of coverage with TFS, repair the vehicle.
b. Collect the deductible, if any, from the customer.
c. Provide the customer a copy of the Repair Order.
d. Provide a copy of the Repair Order to TFS, if required.

4. Repair Order

The dealership must retain the repair order in their files for a period of seven (7) years from the date of the repairs.

Note: TFS may request an inspection of the vehicle by an independent third party prior to the claim authorization. A claims representative will advise the dealership of the results of the inspection and authorize the repair, if applicable.

Platinum, Certified Platinum VSA, TCUV Comprehensive Warranty and TCUV Limited Powertrain Warranty Plan Coverage

All manufacturer-original equipment parts installed by the manufacturer or a Toyota Dealer are covered for mechanical failures, unless otherwise excluded.

The items below are NOT covered:

Accessory Drive Belts
Batteries
Body Panels
Brake Linings, Pads and Shoes, Rotors and Drums
Bumpers
Carpet
Chrome
Clutch Friction Disc and Pressure Plate
Dash Cover and Pad
Door Trim, Handles, and Fabric
Filters
Fluids
Glass (including Windshields)
Headliner
Heating Hoses, Lines, and Tubes
Hinges
Hoses
Hybrid Vehicle Battery Pack*
Hybrid Vehicle Battery Plug Assembly*
Hybrid Vehicle Relay Assembly*
Hybrid Vehicle Supply Battery Assembly*
Interior and Exterior Trim and Moldings (including but not limited to Ash Trays, Covers, Cup Holders, and Vents)
Lamps (Back-up, Fog Light, Side Marker, and Turn Signal Light Assemblies)
Light Bulbs
Nuts, Bolts, Clips, Retainers, and Fasteners
Paint
Rust and Corrosion Damage
Seat Covers
Sheet Metals
Shiny Metals
Spark Plugs
Structural Framework and Welds
Tires
Vacuum Hoses, Lines, and Tubes
Weather Stripping
Wheels and Rims
Windshield Wiper Blades (Rubber Component)

* Covered under the Toyota Hybrid System Warranty. Refer to Owner's Warranty and Maintenance Guide for details.

Toyota Financial Services is a service mark of Toyota Motor Insurance Services, Inc. 00975-00734-11 • 11-164 • 12/10

PE11-005

TOYOTA

4/29/2011

ATTACHMENT 7

M.I.L. "ON" DTC P0A78 with Information Codes 286, 287

Service Category Engine/Hybrid System

Section Hybrid/Battery Control System **Market** USA

Toyota Supports ASE Certification

Applicability

YEAR(S)	MODEL(S)	ADDITIONAL INFORMATION
2006 – 2008	Highlander HV	Body Type(s): 5Dr. WagonWagon, Drive Type(s): 2WD, 4WD Engine(s): 3MZ Plant Code(s): 0 Transmission(s): CVT-E, CVT VDS(s): DW21A, EW21A, EW41A, EW44A, GW21A, HW21A WMI(s): JTE

Introduction

Some customers with 2006 – 2008 model year Highlander HV vehicles may experience a M.I.L. “ON” condition with DTC P0A78 with information codes 286 and/or 287 (Drive Motor A Inverter Performance). The inverter with converter assembly has been improved to address this condition.

NOTE

This TSB applies ONLY if information codes 286 AND/OR 287 are present.

Production Change Information

This TSB applies to vehicles produced **BEFORE** the Production Change Effective VINs shown below.

MODEL	DRIVETRAIN	PLANT	PRODUCTION CHANGE EFFECTIVE VIN*
Highlander HV	CVT-E	TMK	JTEEW4#A#82015709

* Underlined number in VIN (11th digit) represents assembly plant line code.

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M.I.L. "ON" DTC P0A78 with Information Codes 286, 287

Warranty Information

OP CODE	DESCRIPTION	YEAR	TIME	OFP	T1	T2
890201	R & R Hybrid Inverter with Converter Assembly	2006-2007	2.1	G92A0-48080 G92A0-48090	8A	74
		2008	2.4	G92A0-48100		

APPLICABLE WARRANTY

- **This repair is covered under the Toyota Hybrid System Warranty. This warranty is in effect for 96 months or 100,000 miles, whichever occurs first, from the vehicle's in-service date.**
- **Warranty application is limited to correction of a problem based upon a customer's specific complaint.**

Parts Information

MODEL YEAR	DRIVETRAIN	PREVIOUS PART NUMBER	CURRENT PART NUMBER	PART NAME	QTY
2006-2007	2WD	G92A0-48090	Same	Inverter w/ Converter Assembly	1
	4WD	G92A0-48080	Same		1
2008	4WD	G92A0-48100	Same		1
–	–	–	00272-SLLC2	Super Long Life Coolant (SLLC)	1

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M.I.L. "ON" DTC P0A78 with Information Codes 286, 287

Required Tools & Equipment

REQUIRED EQUIPMENT	SUPPLIER	PART NUMBER	QTY
TIS Techstream* NOTE: Software version 4.00.017 or later is required.	ADE	TSPKG1	1

* Essential SST.

NOTE

Additional TIS Techstream units may be ordered by calling Approved Dealer Equipment (ADE) at 1-800-368-6787.

REQUIRED SST'S	PART NUMBER	QTY
High Voltage Gloves*	00002-03100-S (Small)	1
	00002-03200-M (Medium)	
	00002-03300-L (Large)	

* Essential SST.

NOTE

Additional SSTs may be ordered by calling SPX/OTC at 1-800-933-8335.

Repair Procedure

Remove and replace the hybrid vehicle inverter with converter assembly.

Refer to the Technical Information System (TIS), applicable model year Highlander HV Repair Manual:

- 2006 / 2007 / 2008 Highlander HV:
  Engine/Hybrid System – Hybrid/Battery Control System – "Hybrid Vehicle Control: Inverter with Converter: Removal"
- 2006 / 2007 / 2008 Highlander HV:
  Engine/Hybrid System – Hybrid/Battery Control System – "Hybrid Vehicle Control: Inverter with Converter: Installation"

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PE11-005

TOYOTA

4/29/2011

ATTACHMENT 9

Modifications/Changes

Subject component	a. Date of change	b. Description of change	c. Reason for change	d. P/N of original component	e. P/N of modified component	f. Original part scrapped?	g. Service availability
Inverter ASSY, with Converter							

PE11-005

TOYOTA

4/29/2011

ATTACHMENT 11-1

THS-II (TOYOTA HYBRID SYSTEM-II)

■DESCRIPTION

1. General

Under the “Hybrid Synergy Drive” concept, the ’06 Highlander hybrid model uses THS-II (Toyota Hybrid System-II). This system optimally effects cooperative control of a high-output 3MZ-FE engine and a high-speed, high-output MG2 through a hybrid transaxle that provides excellent transmission performance. Furthermore, this system uses a high-output HV battery with a nominal voltage of DC 288V, and a variable-voltage system which supplies the HV battery output voltage to MG1, MG2 and MGR* after boosting it and converting it into an alternating current.

2. Driving Performance

- In order to operate MG1 and MG2 powerfully and efficiently, THS-II uses a variable-voltage system that consists of a boost converter and inverter. The boost converter is used to boost the operating voltage of the system to a maximum voltage of DC 650V, and the inverter is used to convert the system voltage (direct current) into an alternating current. By using the variable-voltage system, the electrical loss associated with the supply of electric power at a smaller current is minimized, and MG1 and MG2 are driven at a high voltage. Thus, MG1 and MG2 are operated at high speeds and high outputs.
- A high driving force is achieved through the synergy effect of the high-speed, high-output MG2 and the high-output 3MZ-FE engine.
- The 4WD-i (4 Wheel Drive-intelligent) system model uses an electric type 4WD system. This system, which consists of MGR (Motor Generator Rear) in the rear drive unit, drives the rear wheels in accordance with driving conditions, thus realizing a high driving force.

3. Fuel Economy Performance

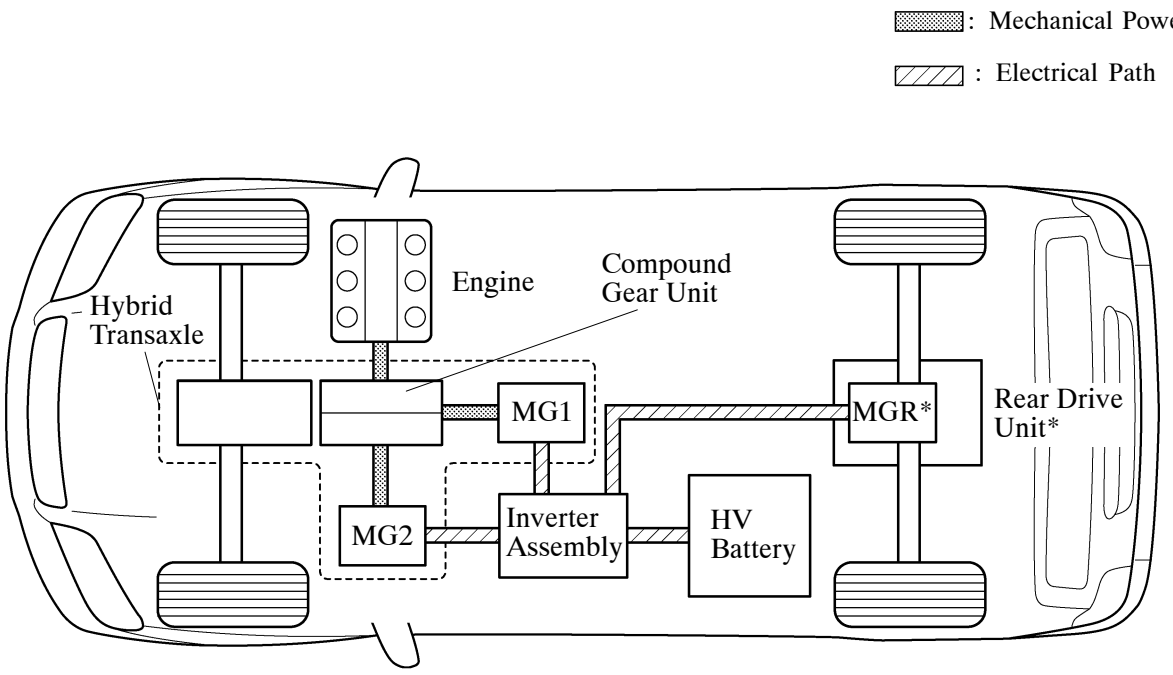
- By optimizing the internal construction of MG2 and MGR*, this system realizes a high level of regenerative capability, thus realizing a high level of fuel economy performance.
- This system stops the engine while the vehicle is idling, and stops the engine as much as possible under conditions in which the operating efficiency of the engine is poor, allowing the vehicle to operate using only MG2 or MG2 and MGR*. Under the conditions in which the operating efficiency of the engine is favorable, the engine operates to drive the vehicle using MG1 while generating electricity. Thus, this system effects the input-output control of driving energy in a highly efficient manner to realize a high level of fuel economy.

*: Only on models with 4WD-i system

■FEATURES OF THS-II

1. General

- The THS-II offers the following representative features:
  - Uses a variable-voltage system in which a boost converter boosts the operating voltage of the system to a maximum voltage of DC 650V and an inverter converts the direct current into an alternating current, which supplies the system voltage to MG1, MG2 and MGR*.
  - A motor speed reduction planetary gear unit, whose purpose is to reduce motor speed, is used to enable the high-speed, high-output MG2 to adapt optimally to the power split planetary gear unit in the hybrid transaxle.
- The THS-II consists primarily of the following components:

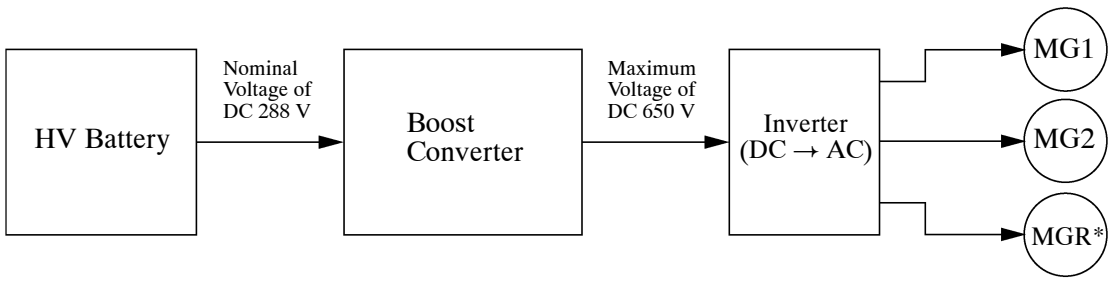


*: Only on model with 4WD-i system

282TH01

2. Variable-voltage System

In the THS-II of the ’06 Highlander hybrid model, a boost converter is used inside the inverter assembly. The boost converter boosts the system operating voltage to a maximum voltage of DC 650V and the inverter converts direct current into alternating current, in order to drive MG1, MG2 and MGR* at a high voltage as well as minimize the electrical loss associated with the electric power supply at a smaller current. Thus, MG1, MG2 and MGR can be operated at high speeds and high output.



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*: Only on models with 4WD-i system

3. Clutch-Less System

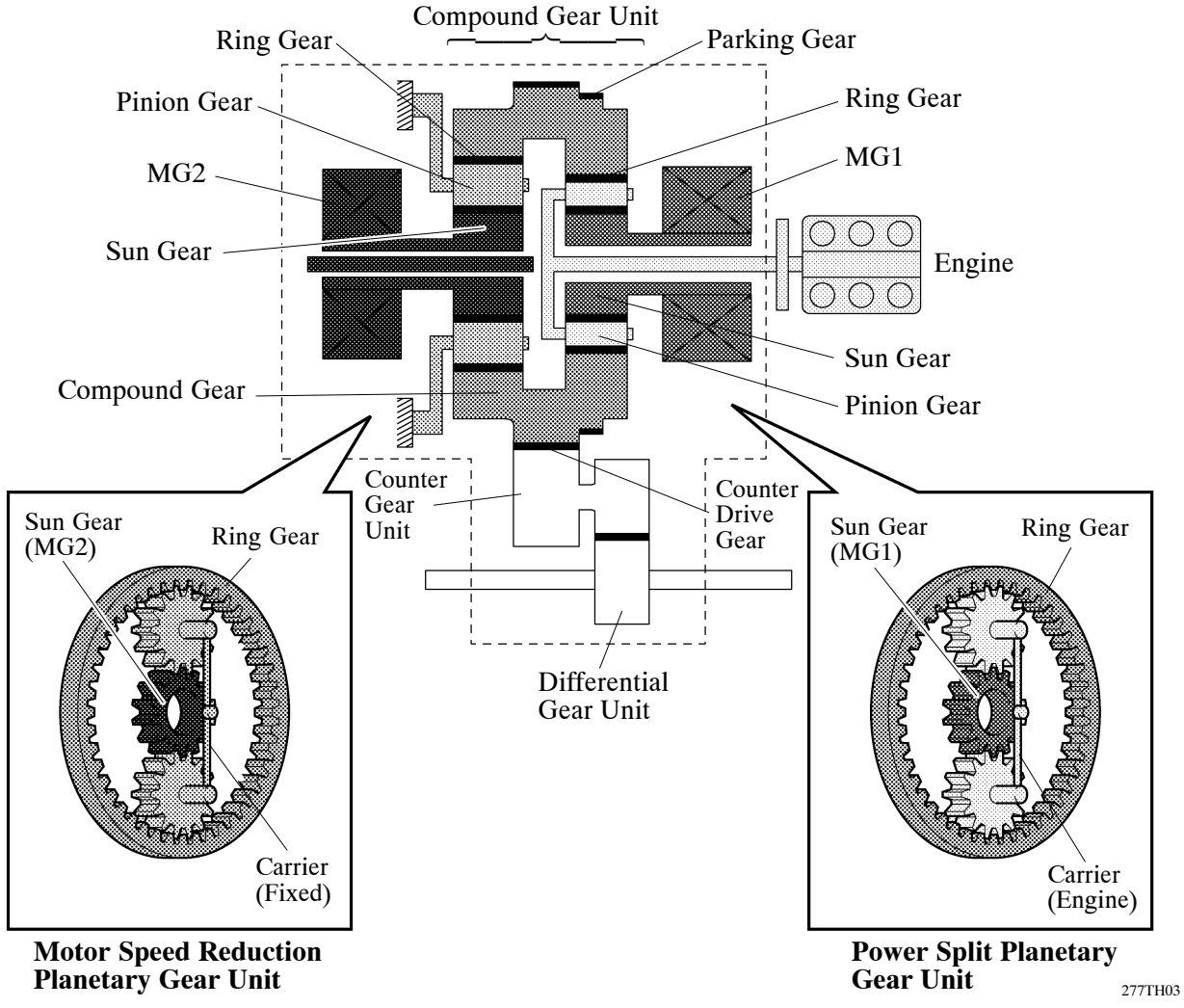
A clutch-less system is used to mechanically link the front wheels and MG2 via gears. To disengage the motive force in the neutral position, the shift position sensor outputs an N position signal to turn OFF all the power transistors in the inverter (which connects MG1 and MG2). As a result, the operation of MG1 and MG2 shuts down, thus rendering the motive force at the wheels to zero.

4. Hybrid Transaxle

- This system drives the vehicle by combining the motive forces of the engine and the MG2 in an optimal manner in accordance with the driving conditions of the vehicle. In this system, the engine power forms the basis. The power split planetary gear unit in the hybrid transaxle splits the engine power two ways: one to drive the wheels, and the other to drive MG1, so that it can function as a generator.
- This hybrid transaxle consists primarily of MG1, MG2, a compound gear unit (which consists of a motor speed reduction planetary gear unit and a power split planetary gear unit), a counter gear unit, and a differential gear unit.
- The engine, MG1 and MG2 are mechanically joined via the compound gear unit.
- The compound gear unit contains a motor speed reduction planetary gear unit and a power split planetary gear unit. The motor speed reduction planetary gear unit reduces the rotational speed of MG2, and the power split planetary gear unit splits the motive force of the engine two ways: one to drive the wheels, and the other to drive MG1, so that it can function as a generator.
- In the motor speed reduction planetary gear unit, the sun gear is coupled to the output shaft of MG2, and the carrier is fixed. Furthermore, the compound gear unit uses a compound gear, in which two planetary ring gears, a counter drive gear, and a parking gear are integrated.

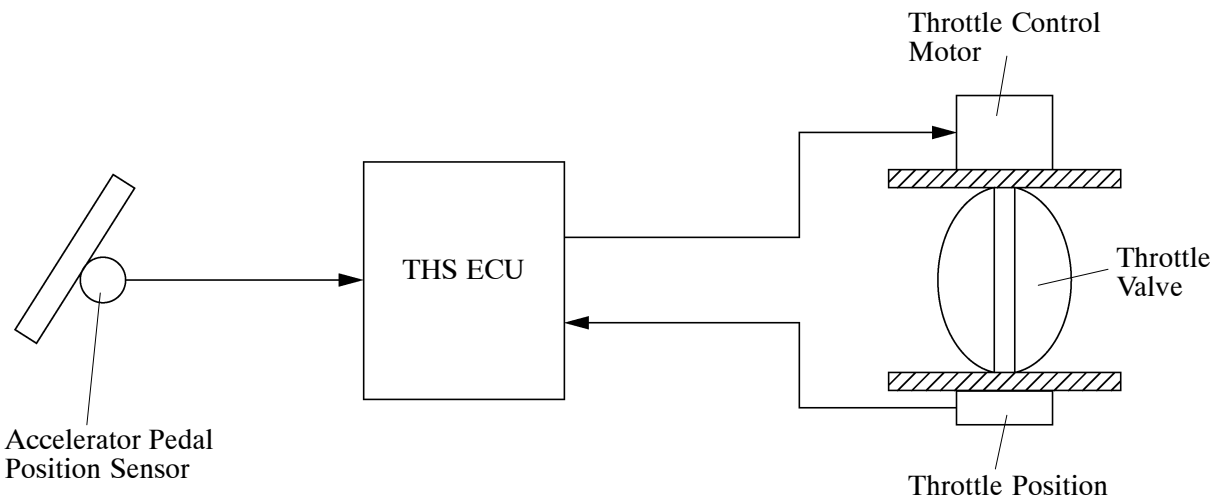
For details, refer to P310 Hybrid Transaxle on page CH-2.

▶ Image Diagram ◀



5. Link-Less

The ETCS-i (Electronic Throttle Control System-intelligent) is used. This is a link-less system that does not use an accelerator cable. Instead, it uses an accelerator pedal position sensor and a throttle position sensor to detect the accelerator pedal position and the throttle position.
The THS ECU calculates the target engine speed and the required engine motive force in accordance with the signals provided by the accelerator pedal position sensor, vehicle driving conditions, and the SOC (state of charge) of the battery. Based on the results of this calculation, the THS ECU optimally controls the throttle valve. For details, refer to 3MZ-FE Engine on page EG-46.



6. Regenerative Brake

The regenerative brake function operates MG2 and MGR* as a generator while the vehicle is decelerating or braking and stores this electrical energy in the HV battery.
For details, refer to Outline of Regenerative Brake Cooperative Control Function in the Brake Control System, on page CH-43.

*: Only on models with 4WD-i system

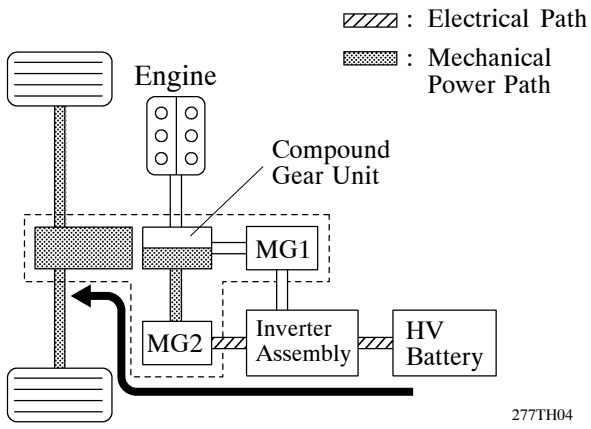
7. Basic Operation

This system generates a motive force in combination with the engine, MG1, MG2, and MGR* in accordance with the driving conditions. Representative examples of the various combinations are described below.

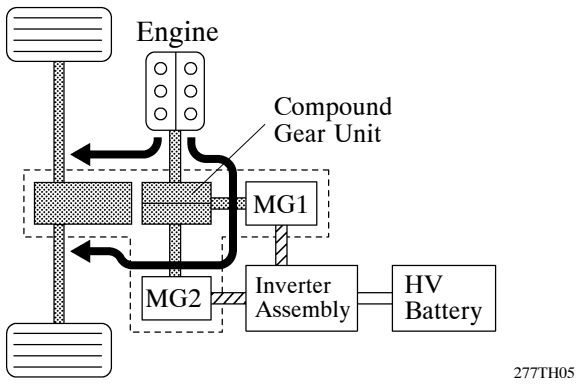
*: Only on models with 4WD-i system

▶ Front Wheel ◀

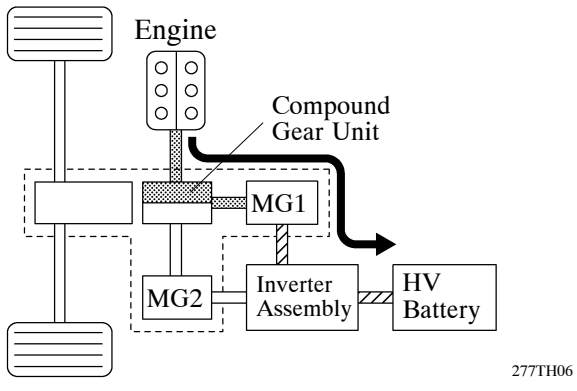
(1) Supply of electrical power from the HV battery to MG2 provides force to drive the front wheels.



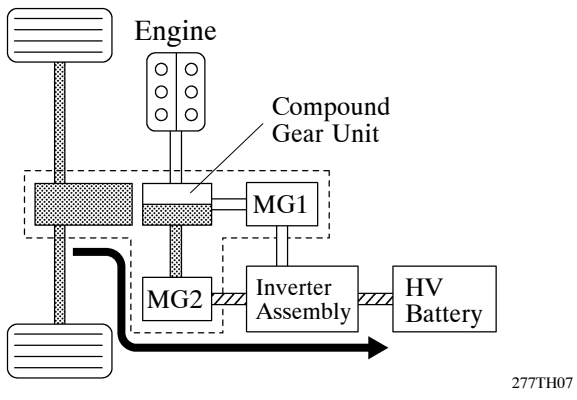
(2) While the front wheels are being driven by the engine via the planetary gears, MG1 is driven by the engine via the planetary gears, in order to supply the generated electricity to MG2.



(3) MG1 is rotated by the engine via the planetary gears, in order to charge the HV battery.

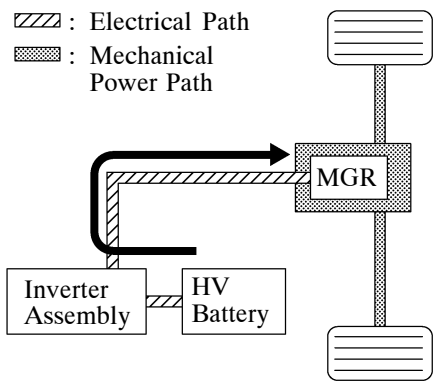


(4) When the vehicle is decelerating, kinetic energy from the front wheels is recovered and converted into electrical energy and used to recharge the HV battery by means of MG2.



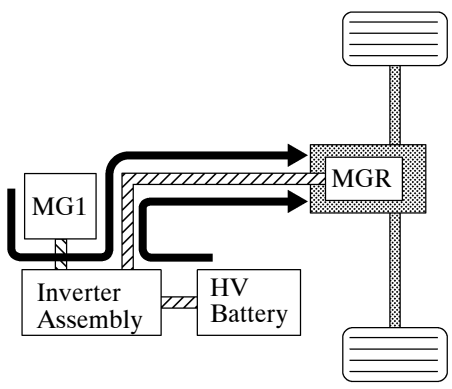
▶ Rear Wheel (with 4WD-i System Model) ◀

(1) To ensure the proper driving force of the vehicle during start-off, or acceleration the electrical power of the HV battery is supplied to MGR in order to drive the rear wheels.



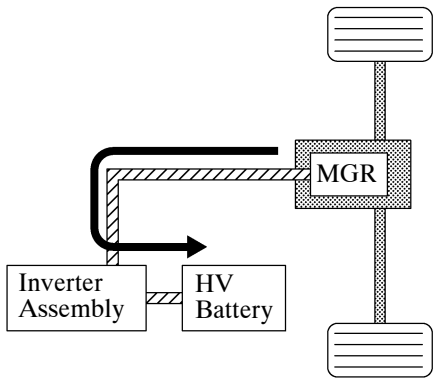
277TH08

(2) During the full throttle acceleration of the vehicle, both the electrical power of the HV battery and the electrical power generated by the MG1 are supplied to the MGR in order to drive the rear wheels.



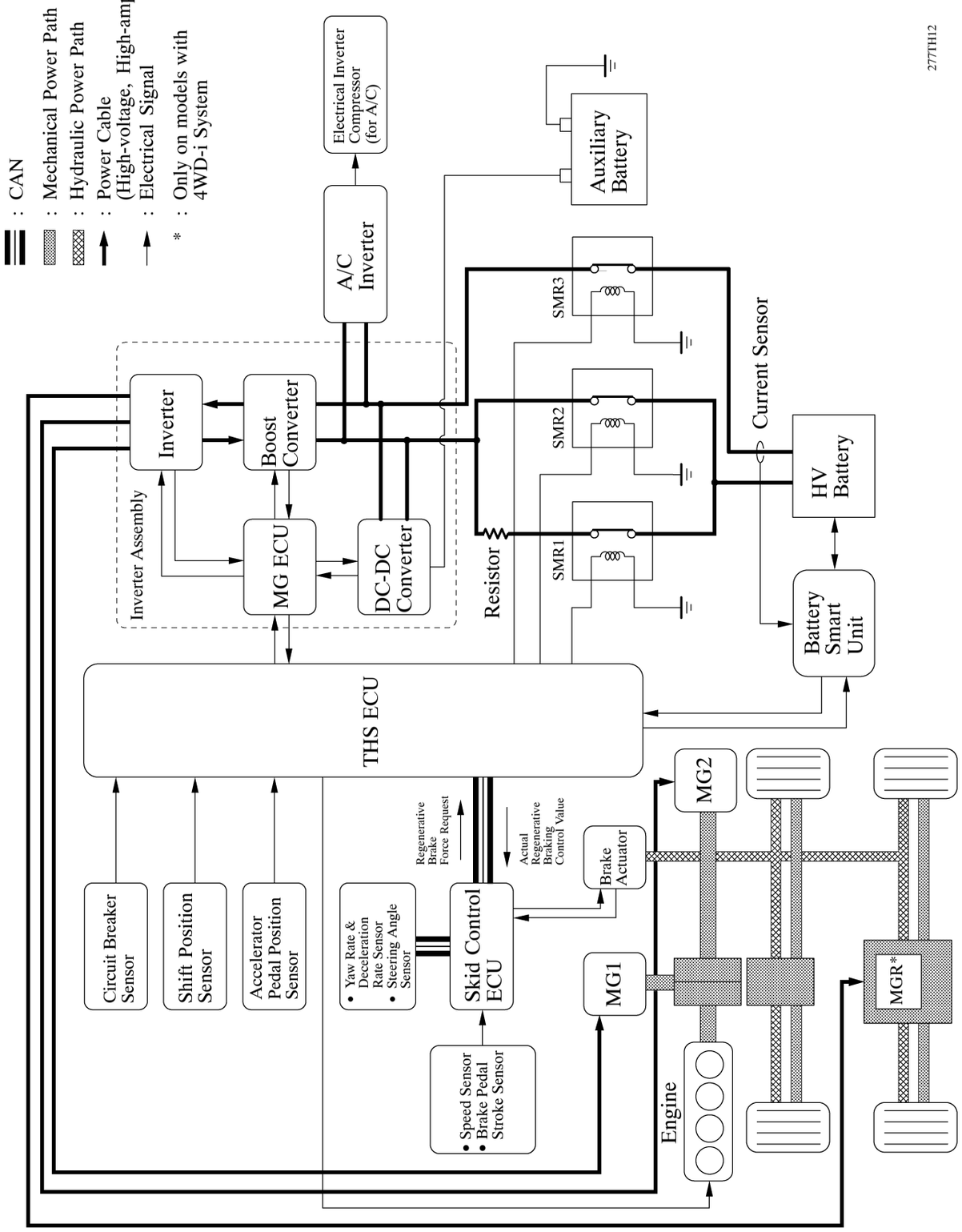
277TH107

(3) When the vehicle is decelerating, kinetic energy from the rear wheels is recovered and converted into electrical energy and used to recharge the HV battery by means of MGR.

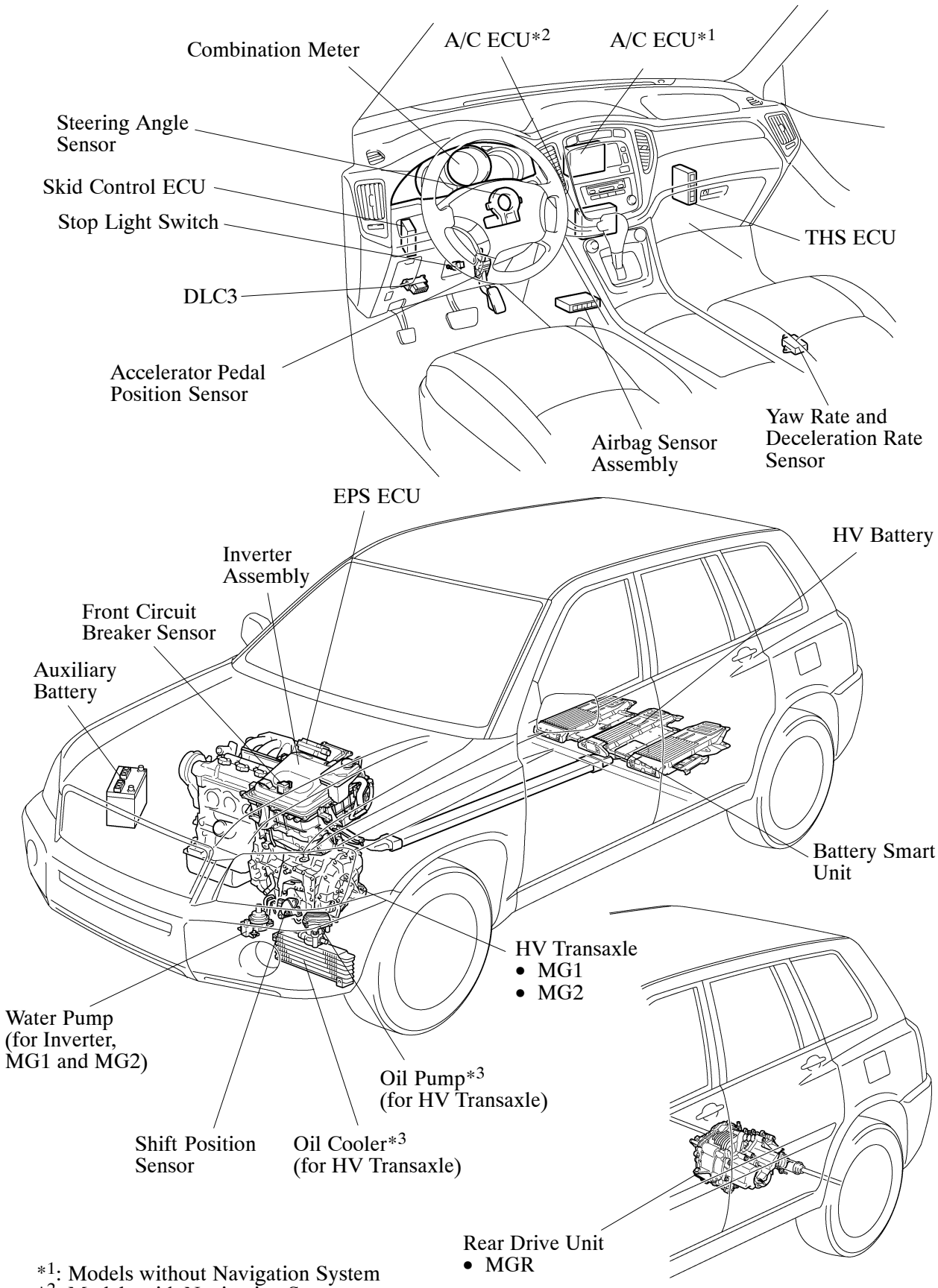


277TH09

■SYSTEM DIAGRAM



■LAYOUT OF MAIN COMPONENTS



*1: Models without Navigation System
*2: Models with Navigation System
*3: Optional equipment

With 4WD-i System Model

282TH02

■FUNCTION OF MAIN COMPONENTS

Item			Outline
Hybrid Transaxle	MG1		• MG1, which is driven by the engine, generates high-voltage electricity in order to operate MG2 or charge the HV battery. Also, it functions as a starter to start the engine. • MG1 operates so that the gear ratio of the power split planetary gear unit will optimally suit the driving conditions of the vehicle.
	MG2		• Driven by electrical power from MG1 or HV battery, and generates motive force for the front wheels. • During braking, or when the accelerator pedal is not depressed, it generates electricity to recharge the HV battery (Regenerative brake control).
	Compound Gear Unit	Power Split Planetary Gear	Distributes the engine's drive force as appropriate to directly drive the vehicle as well as the generator.
		Motor Speed Reduction Planetary Gear	Located between MG2 and the power split planetary gear, the motor speed reduction planetary gear reduces the rotational speed of MG2 in accordance with the characteristics of the planetary gear, in order to increase torque.
Rear Drive Unit*	MGR		• Driven by electrical power from MG1 or HV battery, and generates motive force for the rear wheels. • During braking, or when the accelerator pedal is not depressed, it generates electricity to recharge the HV battery (Regenerative brake control).
HV Battery			• Supplies electrical power to the MG1, MG2, and MGR* in accordance with the driving conditions of the vehicle. • Is recharged by the MG1, MG2, and MGR* in accordance with the SOC and the driving conditions of the vehicle.
Inverter Assembly			A device that converts the high-voltage DC (HV battery) into AC (MG1 and MG2) and vice versa (Converts AC into DC).
	Boost Converter		Boosts the maximum voltage of the HV battery from DC 288 to DC 650V and vice versa (drops DC 650 V to DC 288 V).
	DC-DC Converter		Drops the maximum voltage of DC 288 V into DC12 V in order to supply electricity to body electrical components, as well as to recharge the auxiliary battery (DC 12 V).
	MG ECU		• Controls the inverter and boost converter in accordance with the signals received from the THS ECU, thus driving MG1, MG2, or MGR or causing them to generate electricity. • Controls the DC-DC converter in accordance with the signals received from the THS ECU.
THS ECU			Effects comprehensive control of the THS-II system. • Information from each sensor as well as from the ECU (battery smart unit, skid control ECU, and EPS ECU) is received, and based on this the required torque and output power is calculated. The THS ECU sends the calculated result to the inverter assembly and skid control ECU. • Activates the ETCS-i (Electronic Throttle Control System-intelligent) in accordance with the target engine speed and required engine motive force. • Monitors the charging condition of the HV battery. • Controls the cooling fan of the HV battery.

(Continued)

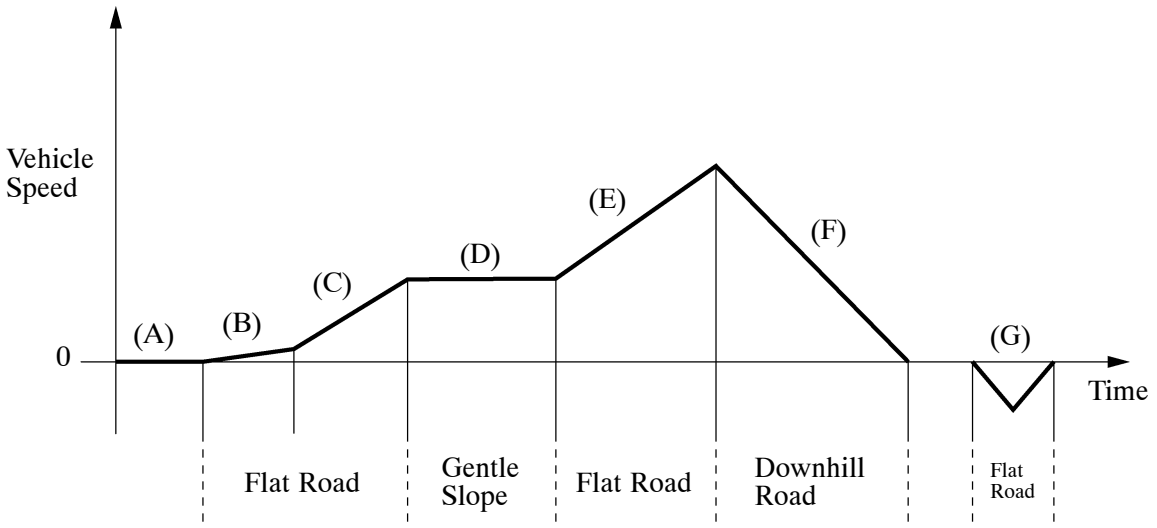
Item	Outline
Battery Smart Unit	• Monitors the conditions of the HV battery and transmits this information to the THS ECU. • Monitors the fault current of the HV battery.
Skid Control ECU	• During braking, it calculates the regenerative brake force that is required for control and transmits it to the THS ECU. • Calculates the motive force that is required for control during the operation of TRAC or VSC and transmits it to the THS ECU. • Transmits a front and rear wheel torque distribution request to the THS ECU for the purpose of 4WD-i system control.*
Accelerator Pedal Position Sensor	Converts the accelerator pedal position into an electrical signal and outputs it to the THS ECU.
Shift Position Sensor	Converts the shift position into an electrical signal and outputs it to the THS ECU.
SMR (System Main Relay)	Connects and disconnects the high-voltage power circuit between battery and inverter assembly, through the use of a signal from the THS ECU.
Interlock Switch (for Inverter Cover and Service Plug)	Verifies that the cover of both the inverter and the service plug have been installed.
Circuit Breaker Sensor	Detects the impact that is applied to the vehicle during a collision and transmits a signal to the THS ECU. Upon receiving this signal, the THS ECU operates the SMR (System Main Relay) to shut down the power supply.
Service Plug	Shuts off the high-voltage circuit of the HV battery when this plug is removed for vehicle inspection or maintenance.

*: Only on models with 4WD-i system

■SYSTEM OPERATION

1. General

- The THS-II system uses the two types of motive forces, the engine and MG2, and uses MG1 as a generator. The system optimally combines these forces in accordance with the various driving conditions.
- The THS ECU constantly monitors the SOC condition, the HV battery temperature, the coolant temperature, and the electrical load condition. If any one of the monitoring items fails to satisfy requirements when the READY indicator is ON and the shift position is in the “P” position, or the vehicle is driven in reverse, the THS ECU demands to start the engine to drive MG1, and then charges the HV battery.
- The THS-II system drives the vehicle by optimally combining the operation of the engine, MG1, and MG2 in accordance with the driving conditions listed in the table below.
- Furthermore, on the 4WD-i system model, MGR drives the rear wheels in accordance with the driving conditions of the vehicle, thus enhancing its driving force.



Driving Condition

277TH14

(A) : READY ON State (See Page TH-14)

(B) : Starting (See Page TH-16)

(C) : During Slight Acceleration with Engine (See Page TH-19)

(D) : During Low Load and Constant-Speed Cruising (See Page TH-20)

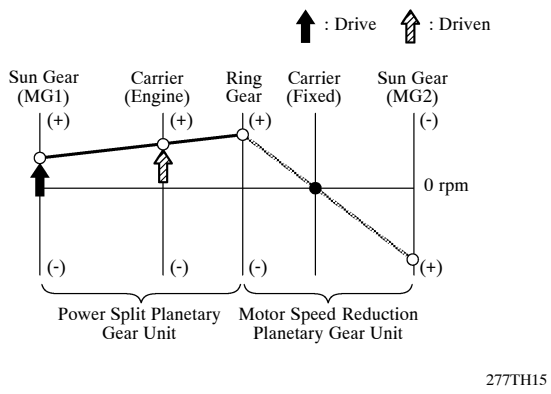
(E) : During Full Throttle Acceleration (See Page TH-21)

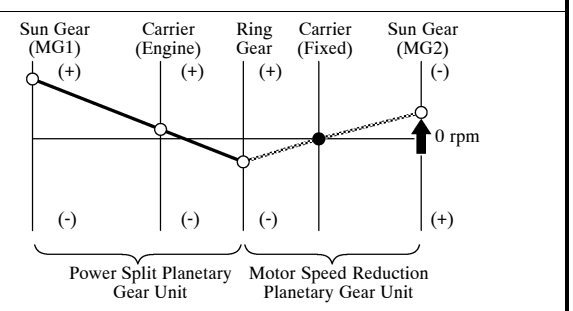
(F) : During Deceleration Driving (See Page TH-22)

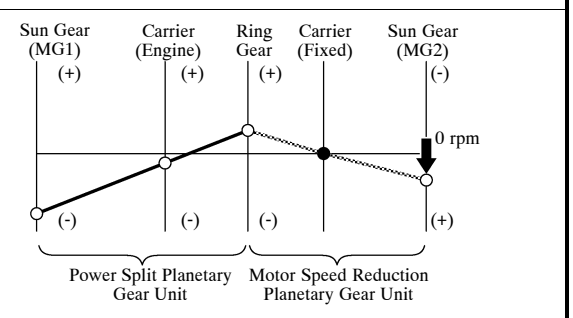
(G) : During Reverse Driving (See Page TH-24)

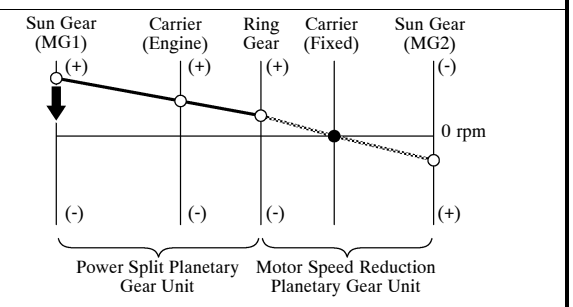
2. How to Read a Nomographic Chart

- The nomographic chart below gives a visual representation of the planetary gear's rotational direction, rotational speed, and power balance. In the nomographic chart, the rpm of the gears used in the power split planetary gear unit and the rpm of the gears used in the motor speed reduction planetary gear unit each maintain relationships indicated by direct lines.
- This nomographic chart describes the charging or generating conditions of MG1 and MG2, their direction of rotation, and torque conditions as indicated in the table below.

<table>
<tr><th>Condition</th><th>Rotation Direction of Ring Gear</th><th>Torque Condition</th><th>Nomographic Chart Example</th></tr>
<tr><td rowspan="3">Discharging</td><td>Forward Revolution
Plus Side</td><td>Plus Direction Torque
Upward Arrow</td><td> 

277TH15</td></tr>
<tr><td>Reverse Revolution
Minus Side</td><td>Minus Direction Torque
Upward Arrow</td><td> 

278TH17</td></tr>
<tr><td>Forward Revolution
Plus Side</td><td>Plus Direction Torque
Downward Arrow</td><td> 

278TH18</td></tr>
<tr><td>Charging</td><td>Forward Revolution
Plus Side</td><td>Minus Direction Torque
Downward Arrow</td><td> 

277TH17</td></tr>
</table>

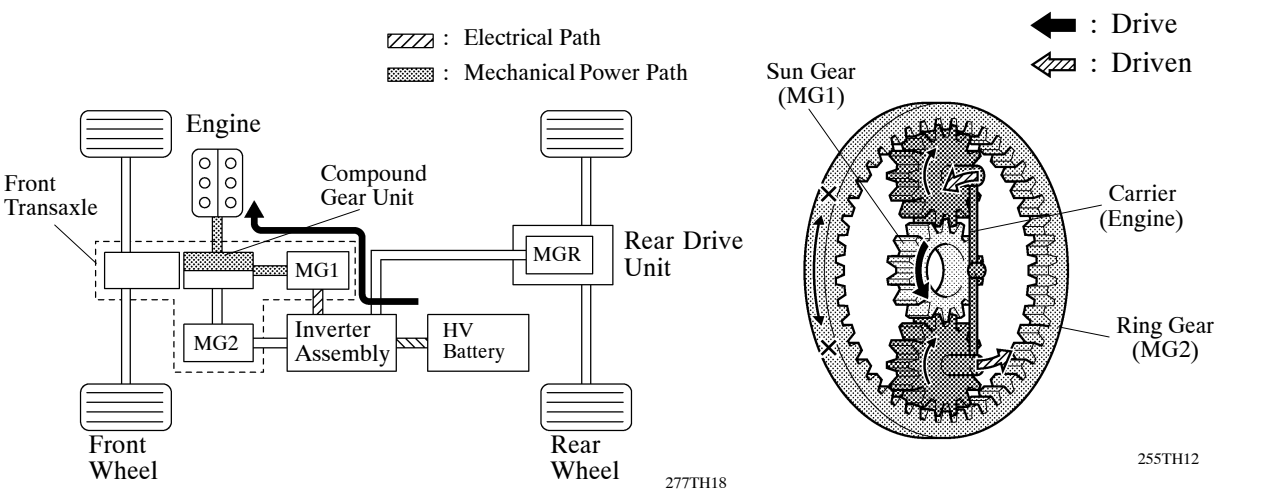
3. READY ON State/(A)

- On the ’06 Highlander hybrid model, even if the driver turns on the ignition switch and the READY indicator turns ON, the engine will not start when the proper engine coolant temperature, SOC conditions, battery temperature and electrical load conditions have been met. In this state, the engine, MG1, MG2 and MGR are all stopped.
- After driving, if the driver stops the vehicle and moves the shift position to the “P”, the THS ECU will continue to operate the engine for a predetermined length of time and will bring the engine to a stop, provided that the proper engine coolant temperature, SOC conditions, battery temperature and electrical load conditions have been met. At this time, the engine, MG1, MG2 and MGR are all stopped.

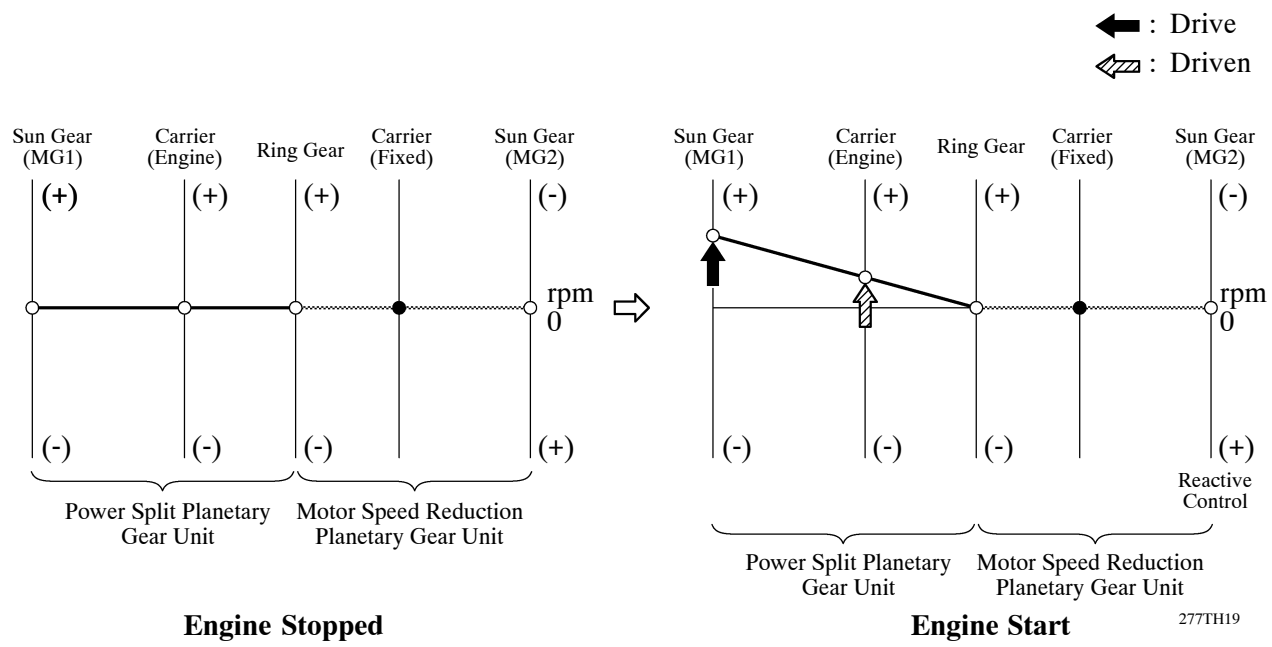
Engine Start

- If any one of the items monitored by the THS ECU is outside the relevant specifications when the READY indicator is ON and the shift position is in the “P” position, the THS ECU activates MG1 to start the engine.
- During this operation, to prevent the reactive force of the sun gear of MG1 from rotating the ring gear of MG2 and driving the drive wheels, an electrical current is applied to MG2 in order to apply the brakes. This function is called “reactive control”.

▶ Power Split Planetary Gear Operation ◀

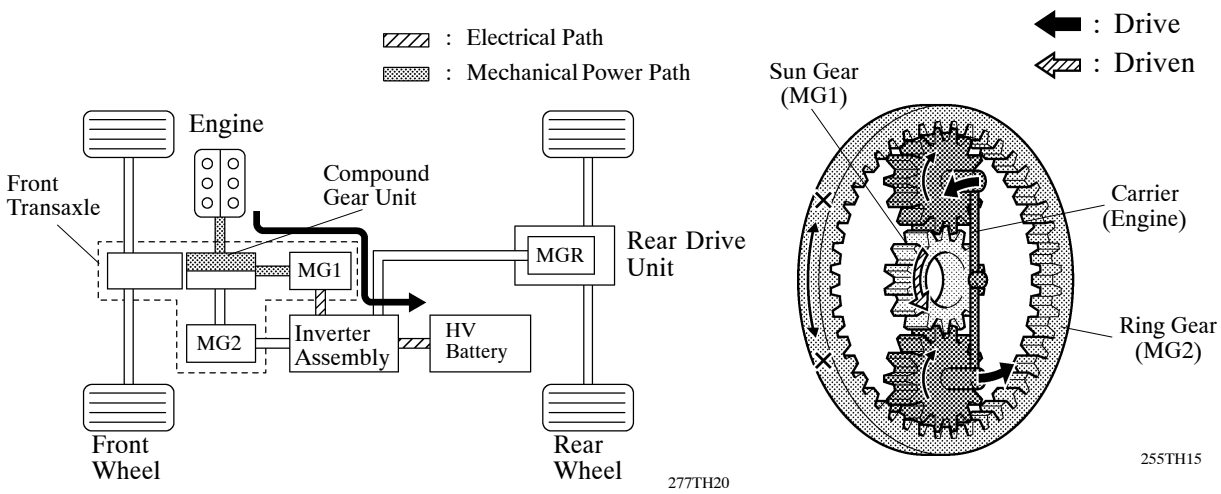


▶ Nomographic Chart of Planetary Gear Unit ◀

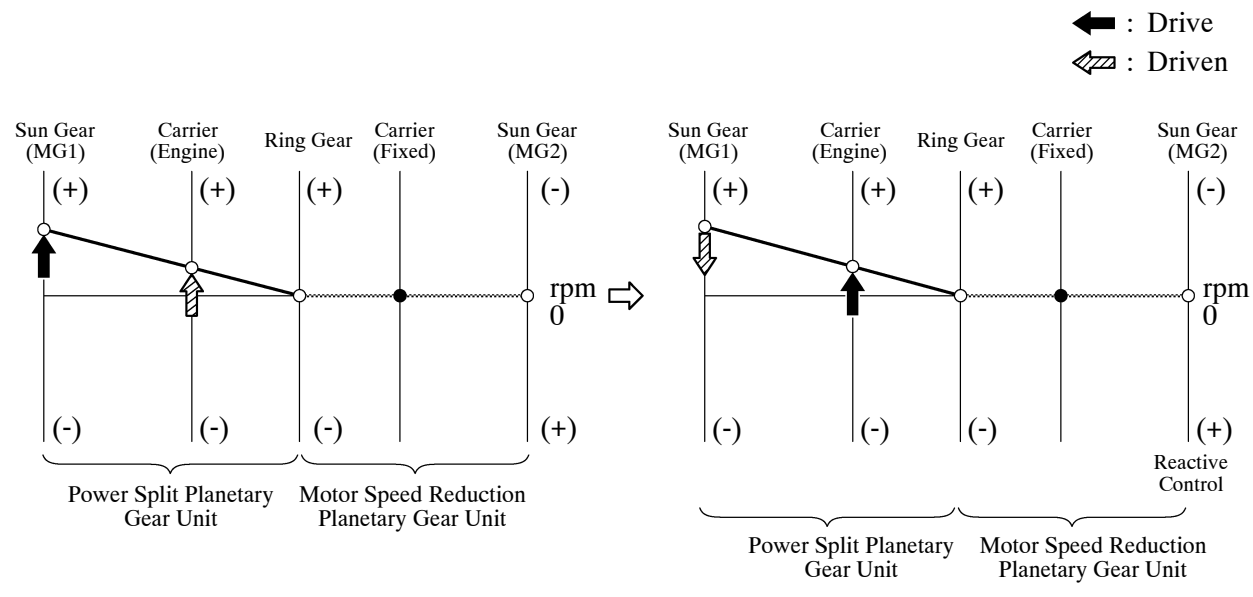


- In the next state, the engine that is running starts to operate MG1 as a generator, which starts to charge the HV battery.

▶ Power Split Planetary Gear Operation ◀



▶ Nomographic Chart of Planetary Gear Unit ◀

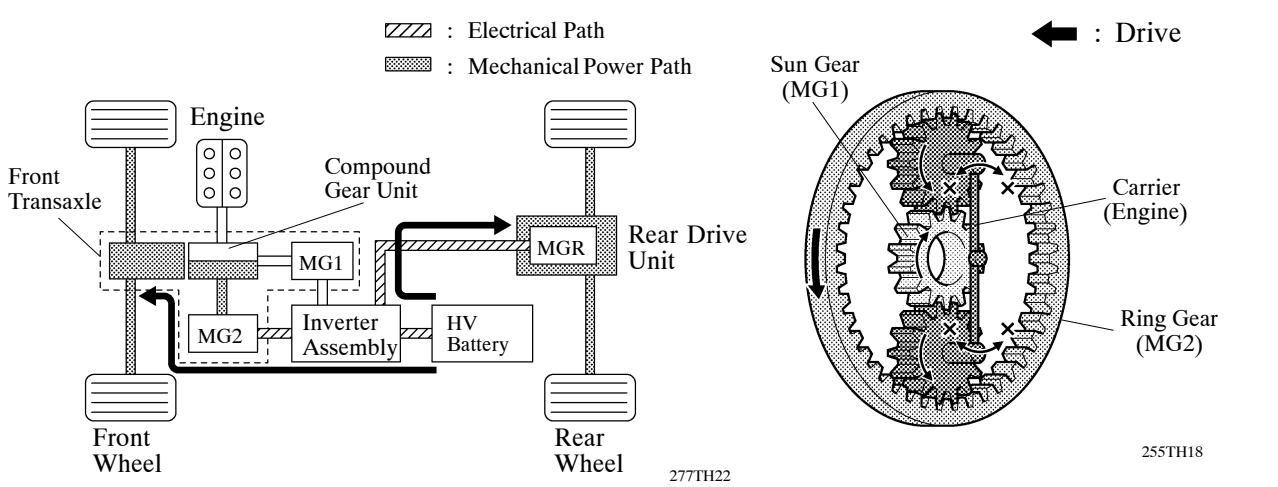


4. Starting/(B)

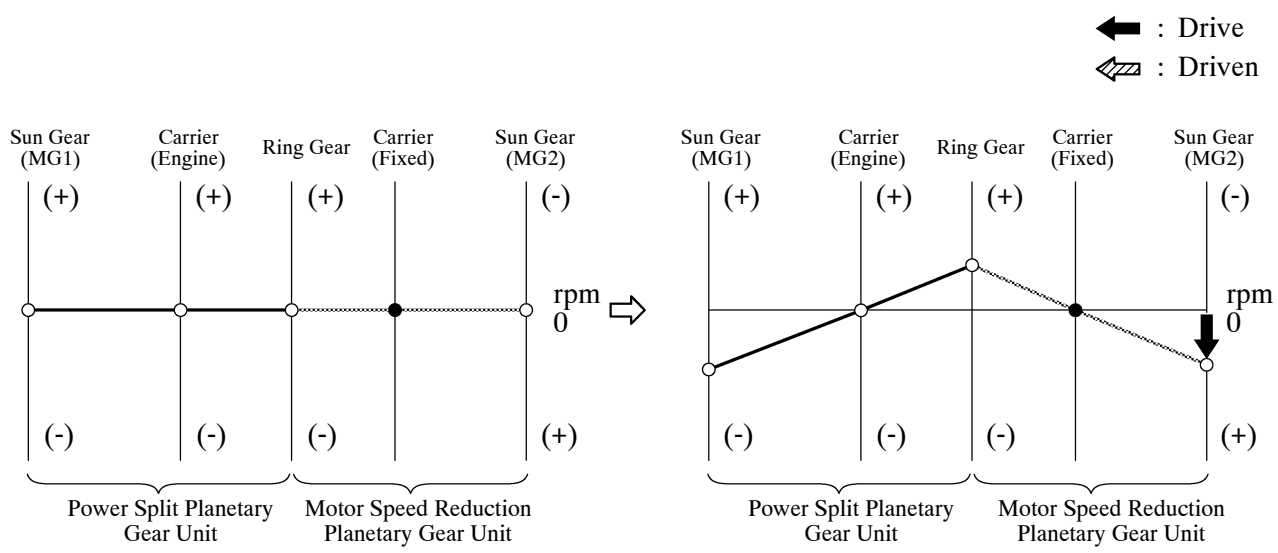
Driving with MG2 and MGR

When the vehicle is started off, the vehicle operates powered only by MG2 and MGR. At this time, the engine remains stopped, and MG1 is spinning in the opposite direction without generating electricity.

▶ Power Split Planetary Gear Operation ◀



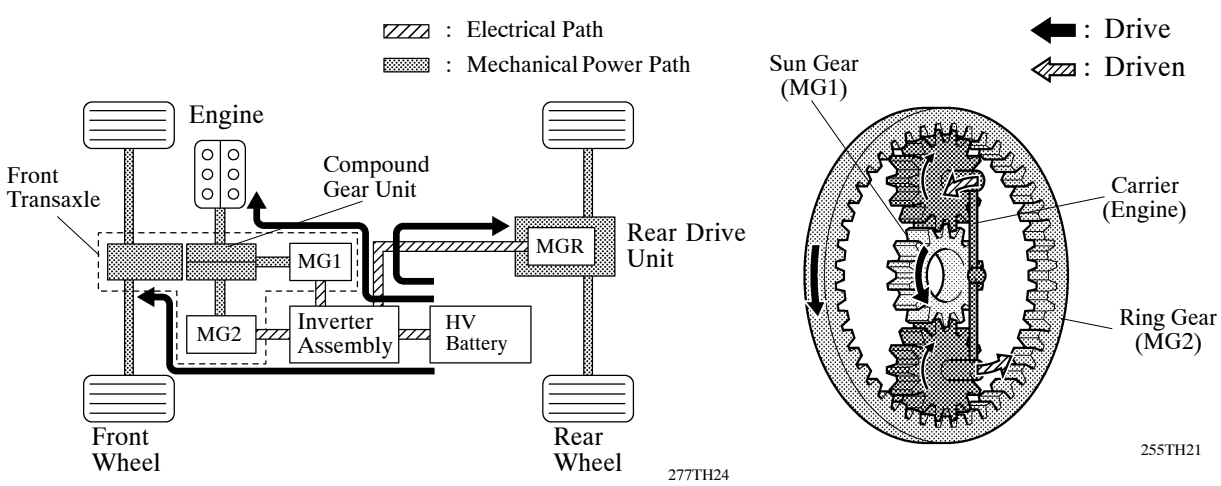
▶ Nomographic Chart of Planetary Gear Unit ◀



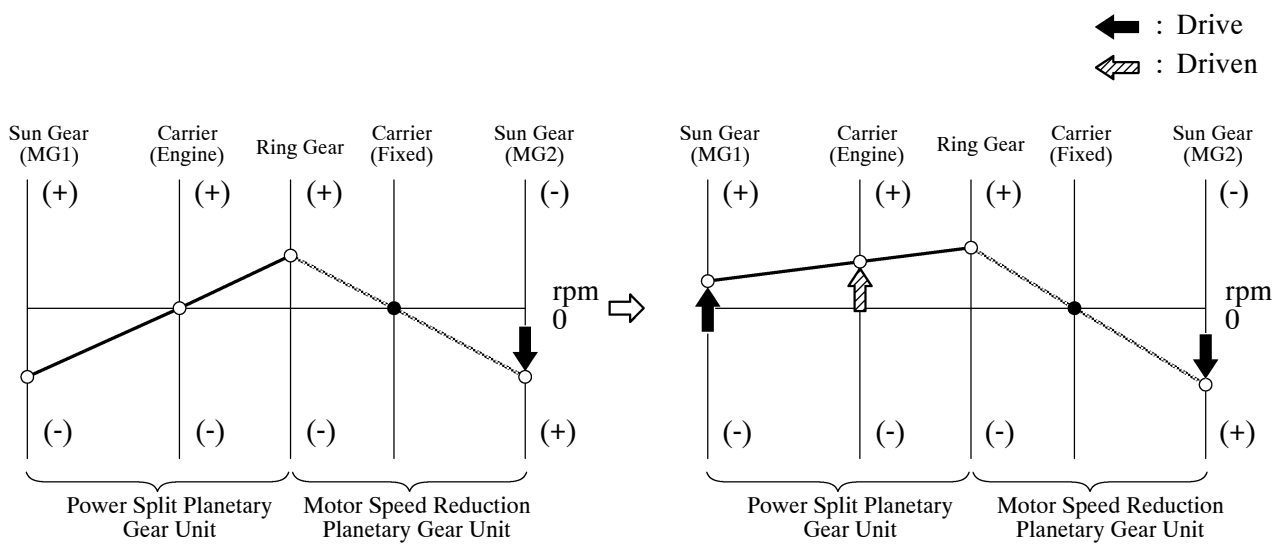
Engine Start

- If the required drive torque increases when running with MG2 and MGR only, MG1 will be activated to start the engine. If, also, any one of the items monitored by the THS ECU such as the SOC condition, the battery temperature, the engine coolant temperature and the electrical load condition deviates from the specified level, MG1 will be activated to start the engine.

▶ Power Split Planetary Gear Operation ◀

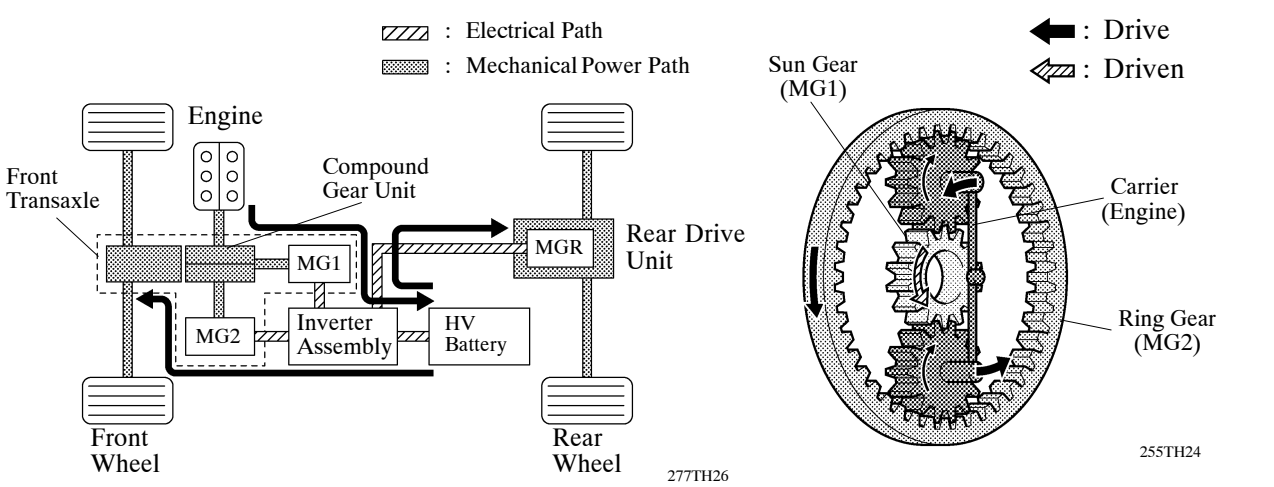


▶ Nomographic Chart of Planetary Gear Unit ◀

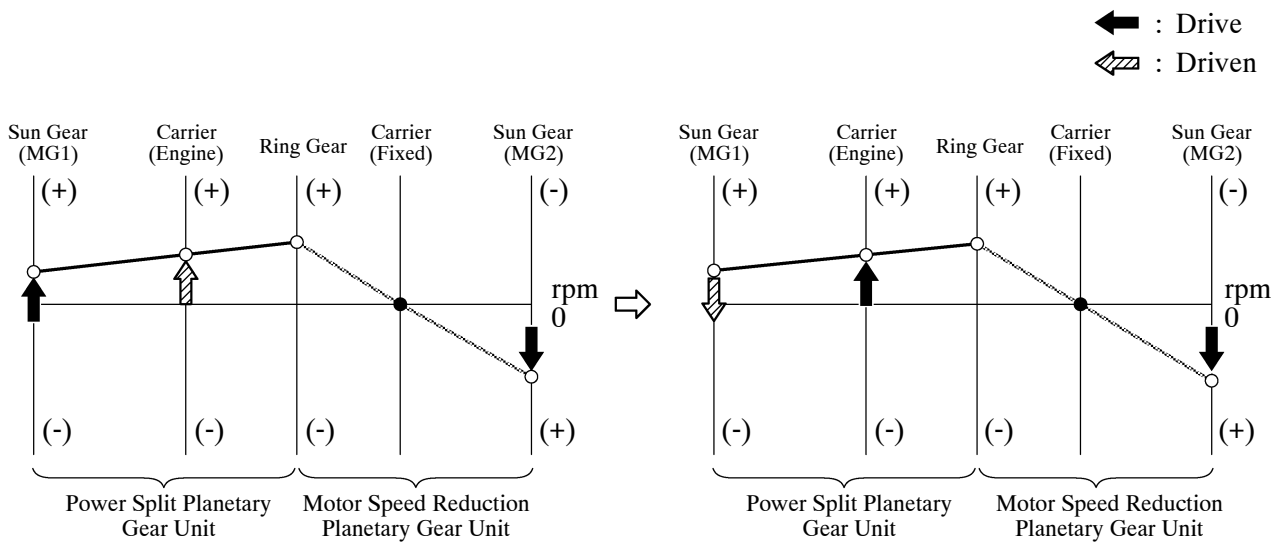


- In the next state, the engine that has been started will operate MG1 as a generator, in order to start charging the HV battery. If the drive torque requirement increases, the system directly uses the electrical power that is generated by MG1 to start driving MG2, in order to transfer to the “During Acceleration with Engine” mode.

▶ Power Split Planetary Gear Operation ◀



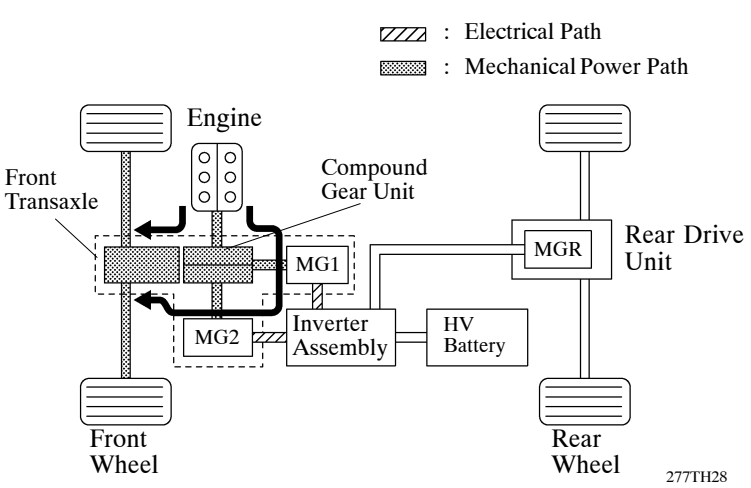
▶ Nomographic Chart of Planetary Gear Unit ◀



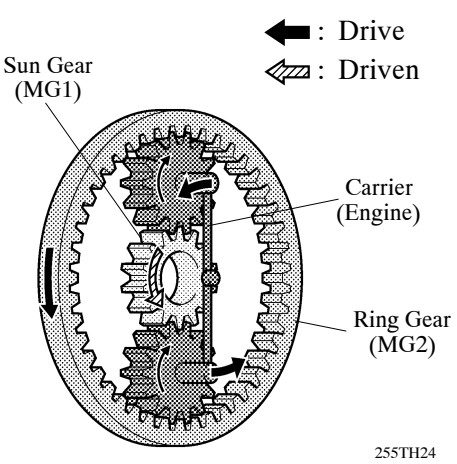
5. During Acceleration with Engine/(C)

- When the vehicle is during acceleration with engine, the motive force of the engine is divided by the planetary gears. A portion of this motive force is output directly, and the remaining motive force is used for generating electricity through MG1. Through the use of an electrical path of an inverter, this electrical force is sent to MG2 to be output as the motive force of MG2.
- On the 4WD-i system model, MGR stops in the “During Acceleration with Engine” mode, in order to make fuel economy a priority.

▶ Power Split Planetary Gear Operation ◀

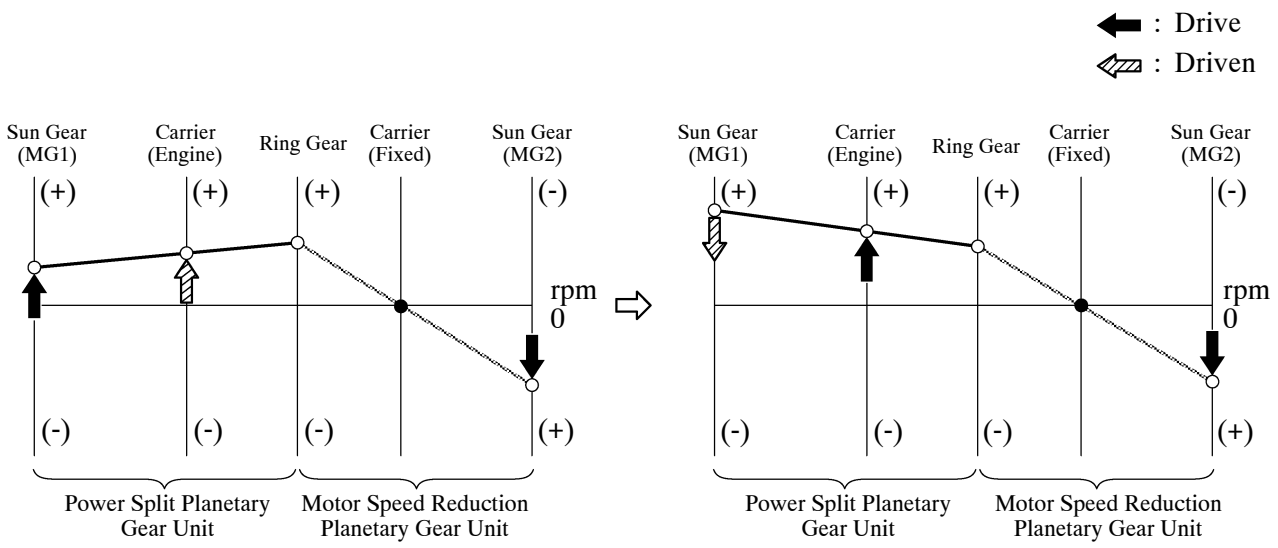


277TH28



255TH24

▶ Nomographic Chart of Planetary Gear Unit ◀



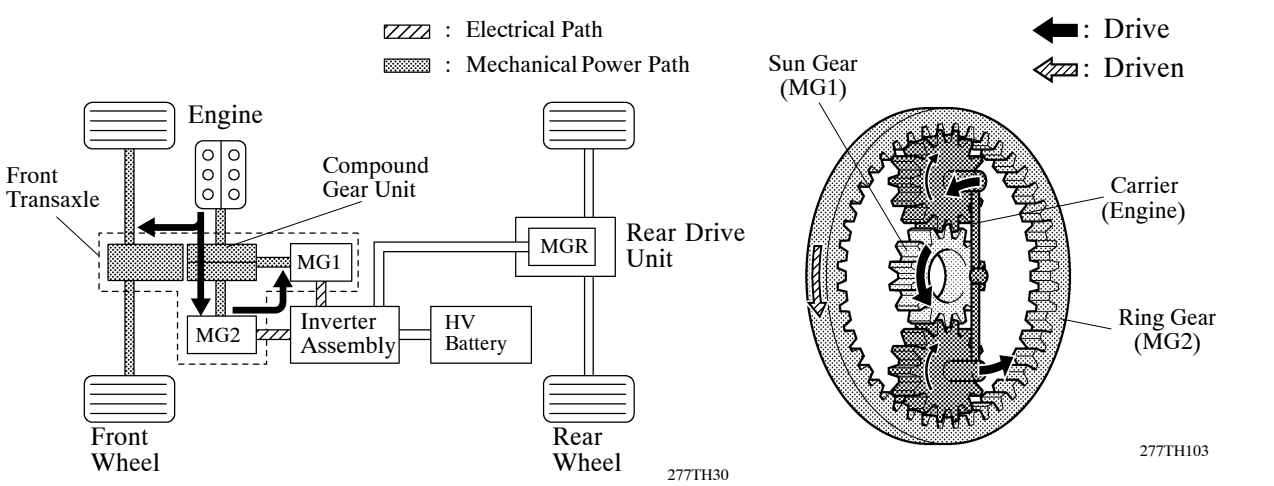
Engine Starts while Driving with MG2 **Normal Driving with Engine**

278TH09

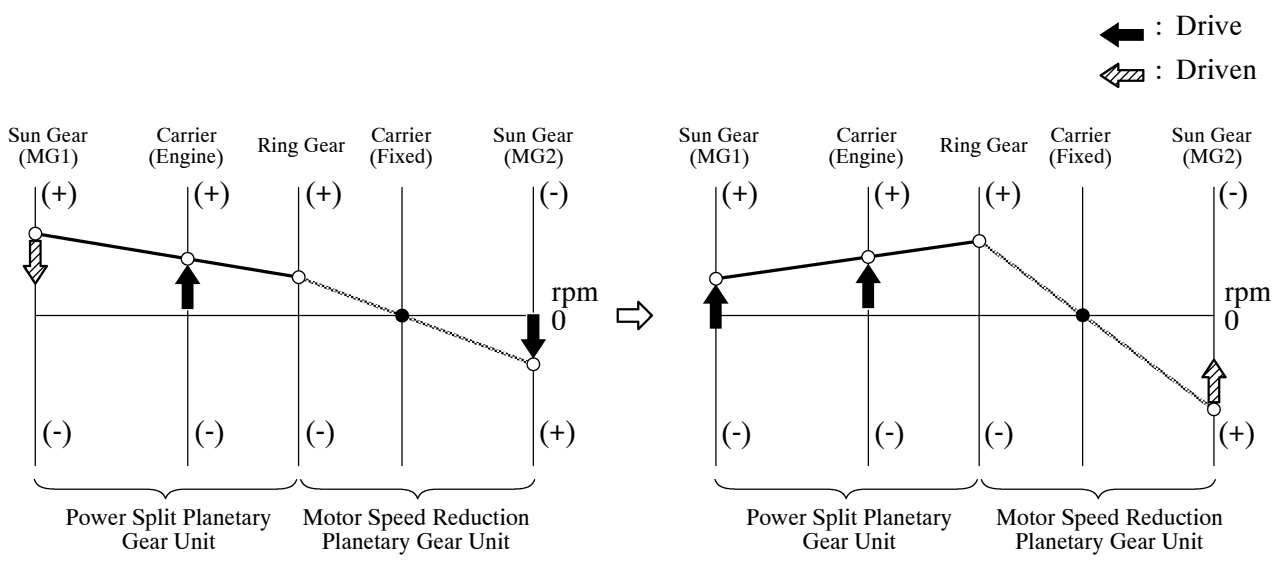
6. During Low Load and Constant-Speed Cruising/(D)

- When the vehicle is operating in the low-load, constant speed cruising mode, the planetary gears split the motive force of the engine two ways: one to directly drive the wheels, and the other to drive MG2. MG2, which is driven by the engine, functions as a generator to generate electricity and drive MG1. As a result of MG1 being driven, the compound gear unit attains an optimum gear ratio, which enables the vehicle to maintain a constant speed. In addition, fuel economy is improved by regulating the engine speed in order to make the engine run more efficiently.
- On the 4WD-i system model, MGR stops in the low-load, constant speed cruising mode, in order to make fuel economy a priority.

▶ Power Split Planetary Gear Operation ◀



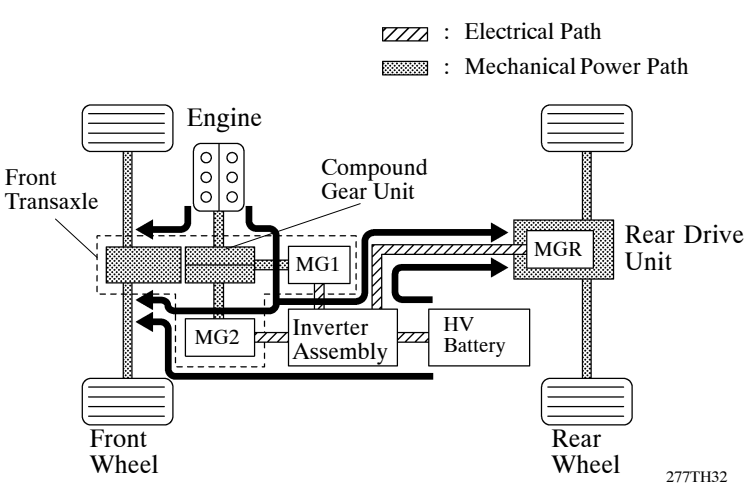
▶ Nomographic Chart of Planetary Gear Unit ◀



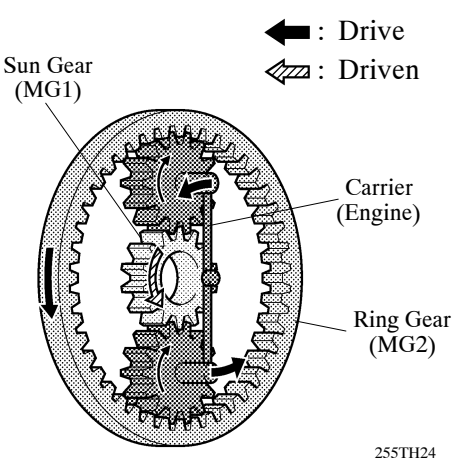
7. During Full Throttle Acceleration/(E)

- When the vehicle transfers from the low load cruising to the full-throttle acceleration mode, the system will add the electrical force of the HV battery to the motive force of MG2.
- On the 4WD-i system model, MGR operates during full throttle acceleration and drives the rear wheels, in order to make acceleration performance a priority.
- Since the HV battery has a limited capacity, when the SOC (state of charge) status falls below a certain level, the electrical force supplied by the HV battery is suspended.

▶ Power Split Planetary Gear Operation ◀

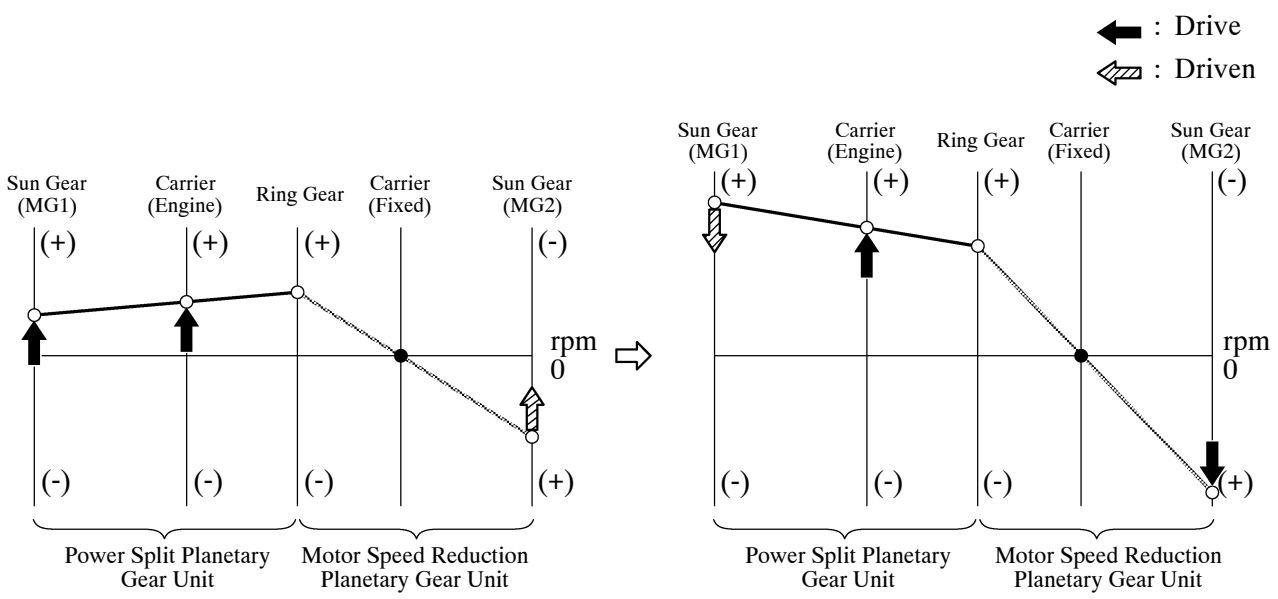


277TH32



255TH24

▶ Nomographic Chart of Planetary Gear Unit ◀



Low Load and Constant-Speed Cruising **Full Throttle Acceleration**

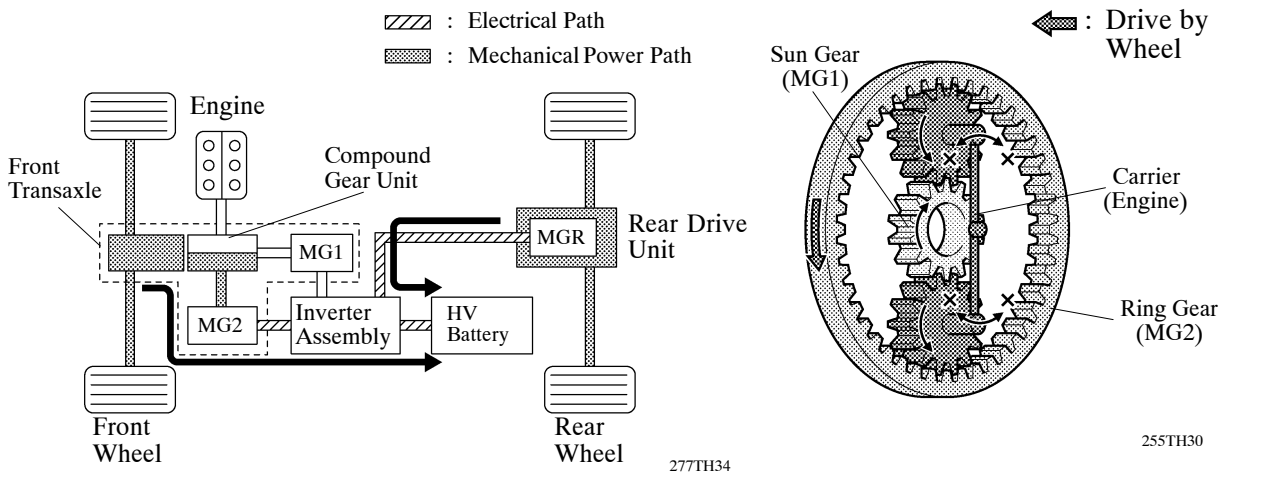
278TH11

8. During Deceleration Driving/(F)

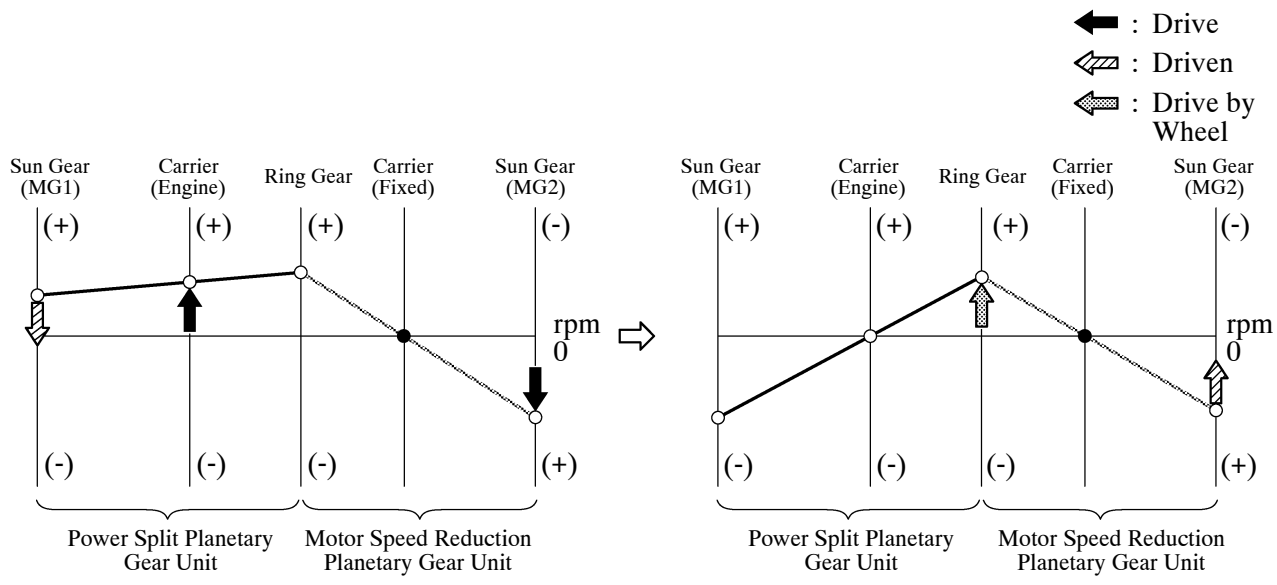
Deceleration in “D” Range

- While the vehicle is being driven with the shift position in the D, and decelerates, the engine turns OFF and the motive force will be zero. At this time, the wheels drive MG2 and MGR, causing MG2 and MGR to operate as a generator and charge the HV battery.
- If the vehicle decelerates from a higher speed, the engine will maintain a predetermined speed without stopping, in order to protect the planetary gear unit.

▶ Power Split Planetary Gear Operation ◀



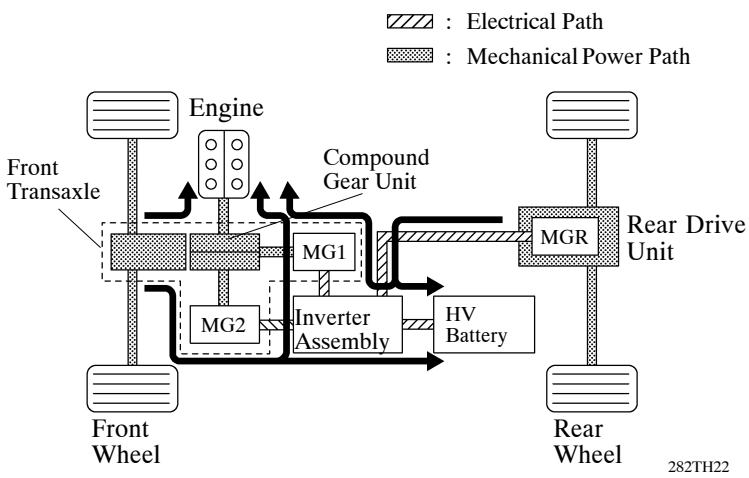
▶ Nomographic Chart of Planetary Gear Unit ◀



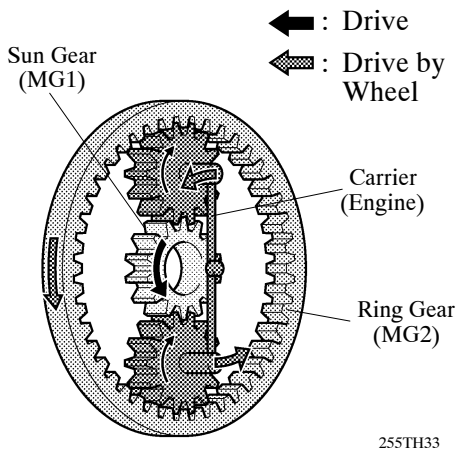
Deceleration in “B” Range

While the vehicle is being driven with the shift position in the B, and decelerates, the wheels drive MG2 and MGR, causing MG2 and MGR to operate as a generator, charge the HV battery, and supply electrical power to MG1. Accordingly, MG1 maintains the speed of the engine and applies an engine brake. At this time, the fuel to the engine is cut.

▶ Power Split Planetary Gear Operation ◀

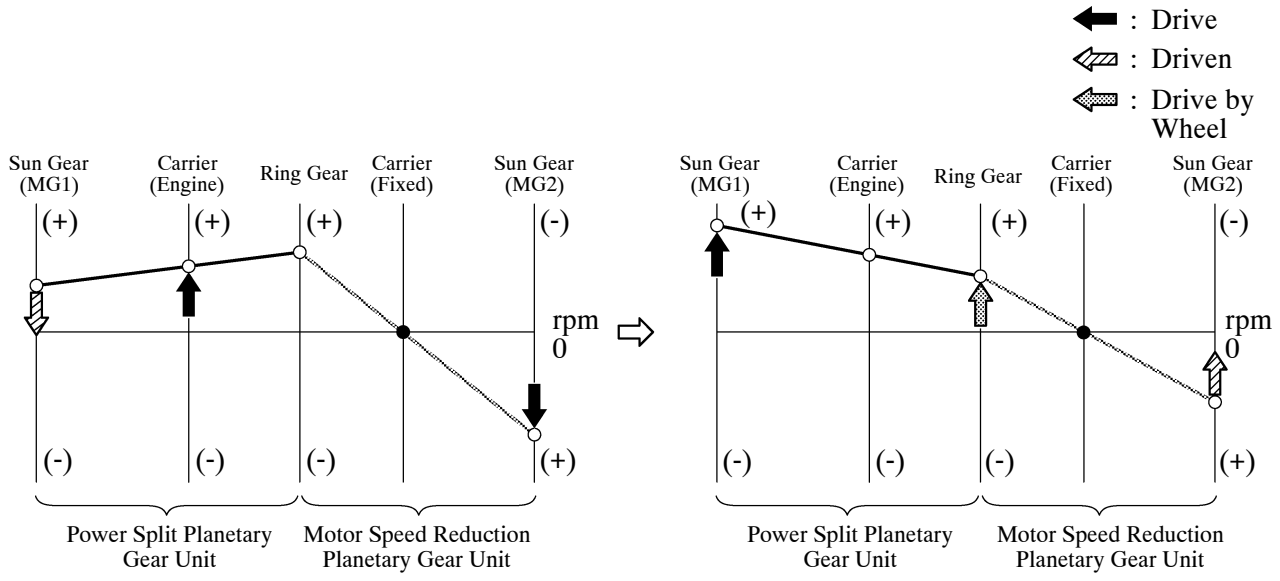


282TH22



255TH33

▶ Nomographic Chart of Planetary Gear Unit ◀



Low Load and Constant-Speed Cruising **Deceleration Driving**

278TH13

During Braking

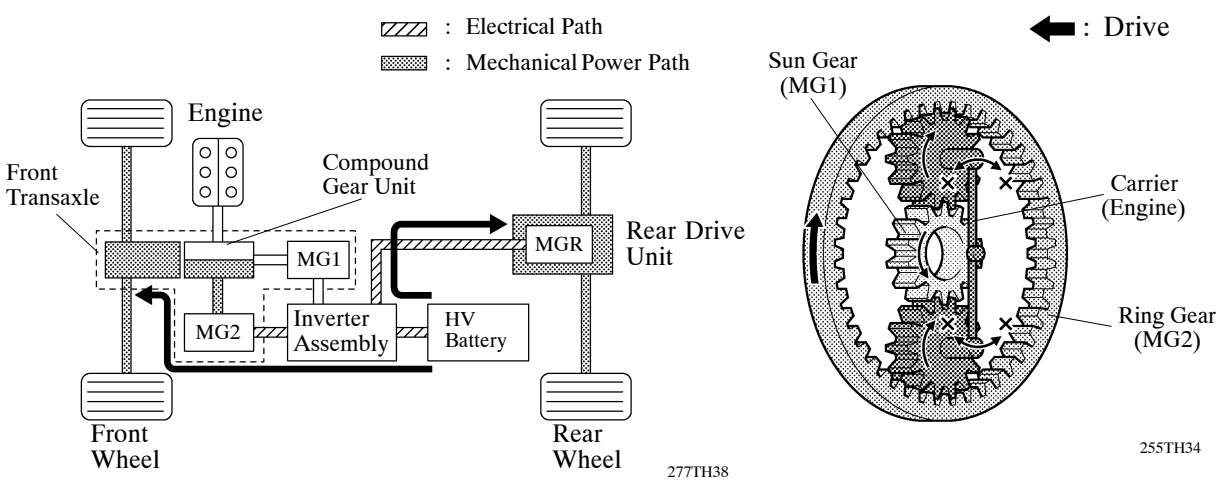
While the vehicle is decelerating, if the driver presses the brake pedal, the skid control ECU calculates the required regenerative brake force and sends a signal to the THS ECU. Upon receiving this signal, the THS ECU increases the regenerative force within a range that suits the required regenerative brake force. As a result, MG2 and MGR will be controlled to generate an ample amount of electricity.

9. During Reverse Driving/(G)

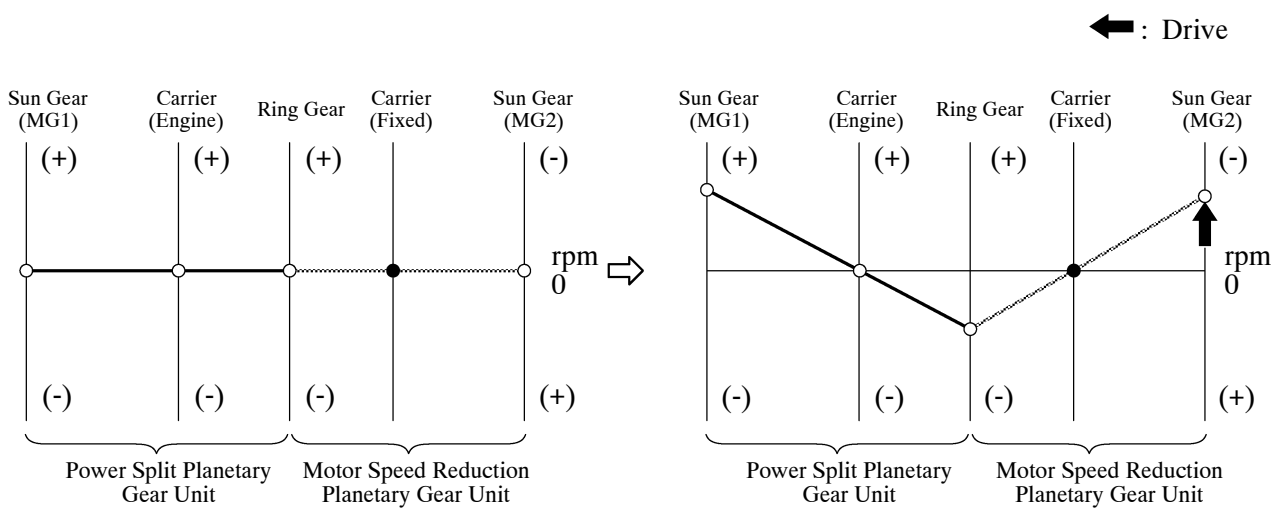
Driving with MG2 and MGR

While the vehicle is being driven in reverse, its power is delivered by MG2 and MGR. At this time, MG2 and MGR is spinning in the opposite direction, the engine remains stopped, and MG1 is spinning in the normal direction without generating electricity.

▶ Power Split Planetary Gear Operation ◀



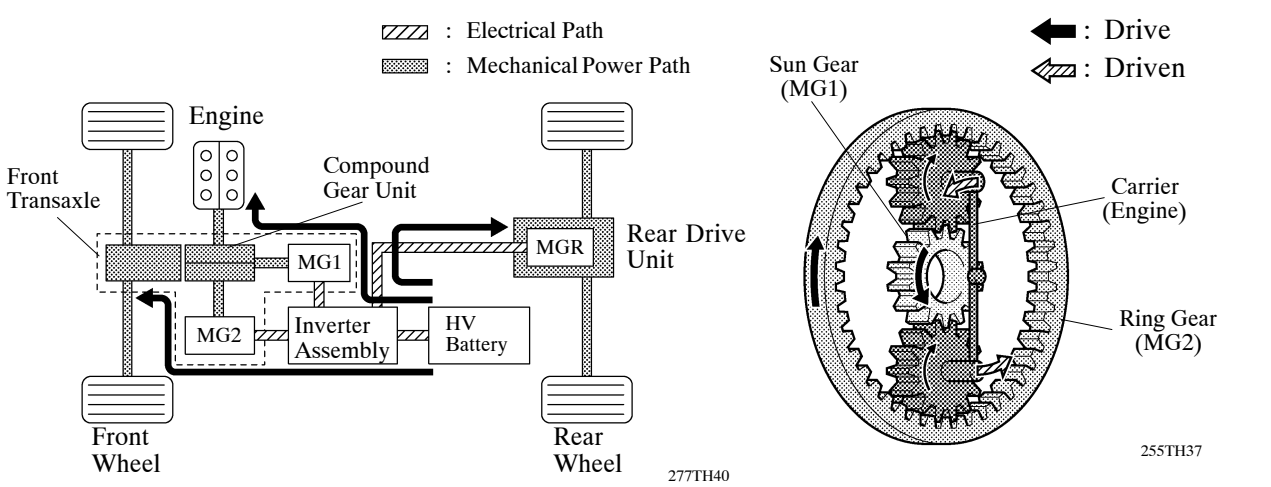
▶ Nomographic Chart of Planetary Gear Unit ◀



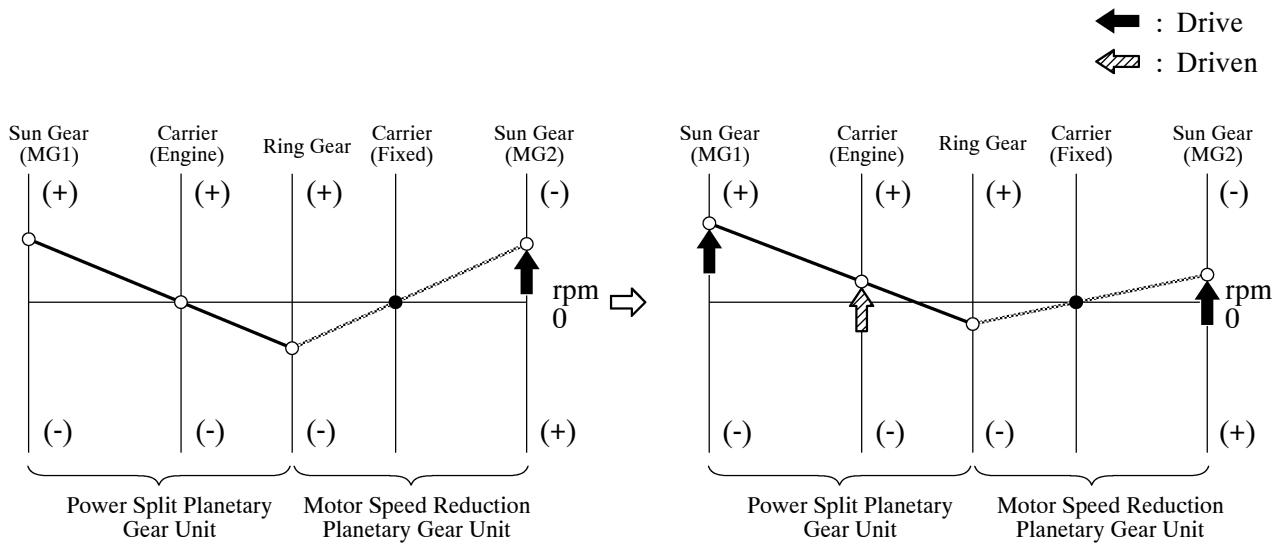
Engine Start

- If, when running with MG2 and MGR only, any one of the items monitored by the THS ECU such as the SOC condition, the battery temperature, the engine coolant temperature and the electrical load condition deviates from the specified level, MG1 will be activated to start the engine.

▶ Power Split Planetary Gear Operation ◀

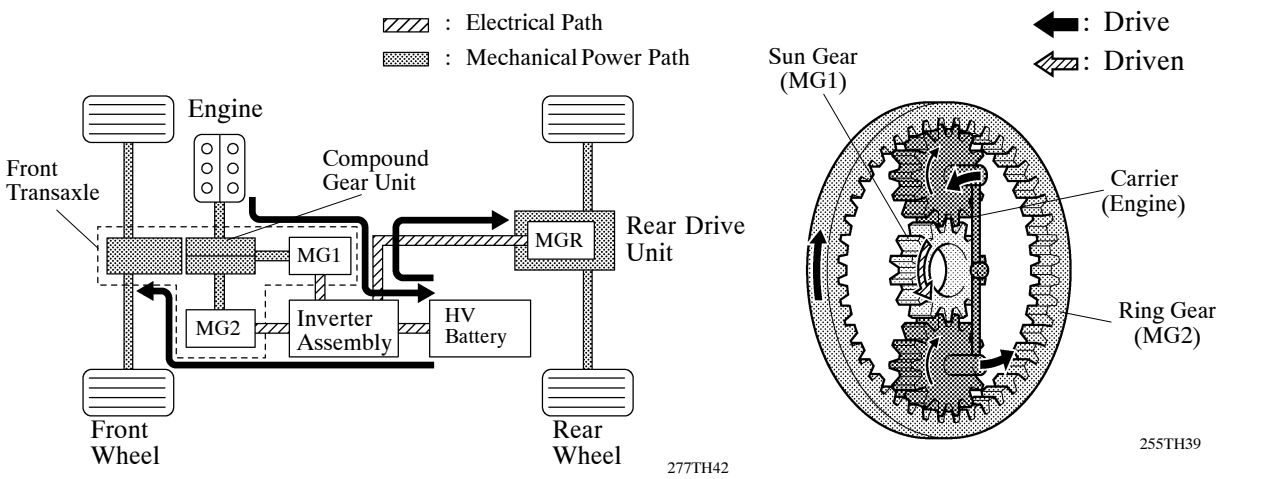


▶ Nomographic Chart of Planetary Gear Unit ◀

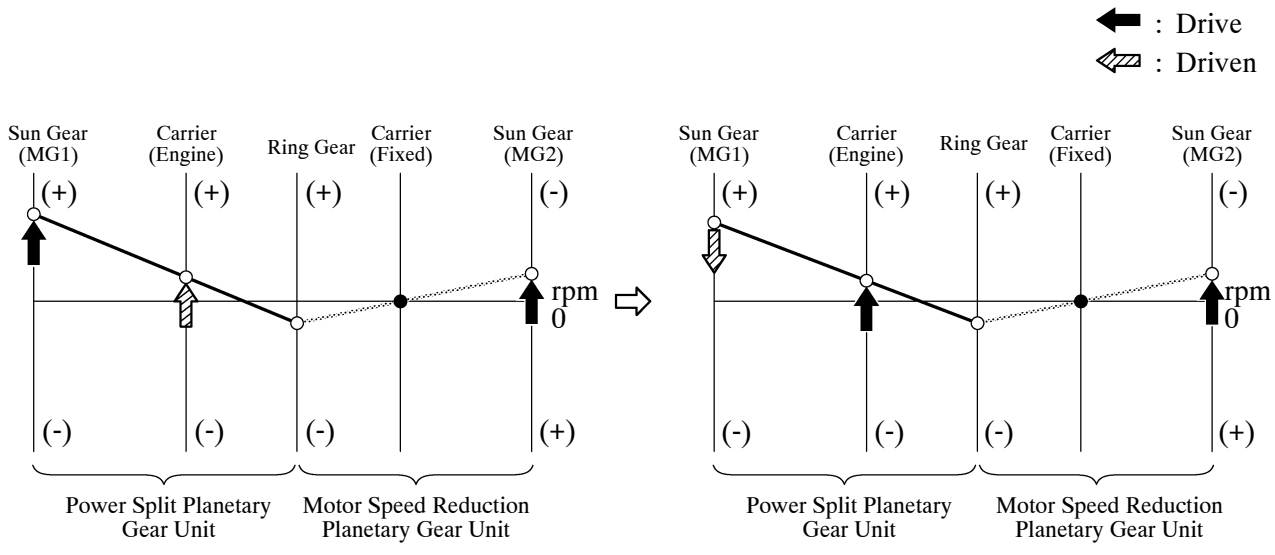


- In the next state, the engine that has been started will operate MG1 as a generator, in order to start charging the HV battery.

▶ Power Split Planetary Gear Operation ◀



▶ Nomographic Chart of Planetary Gear Unit ◀

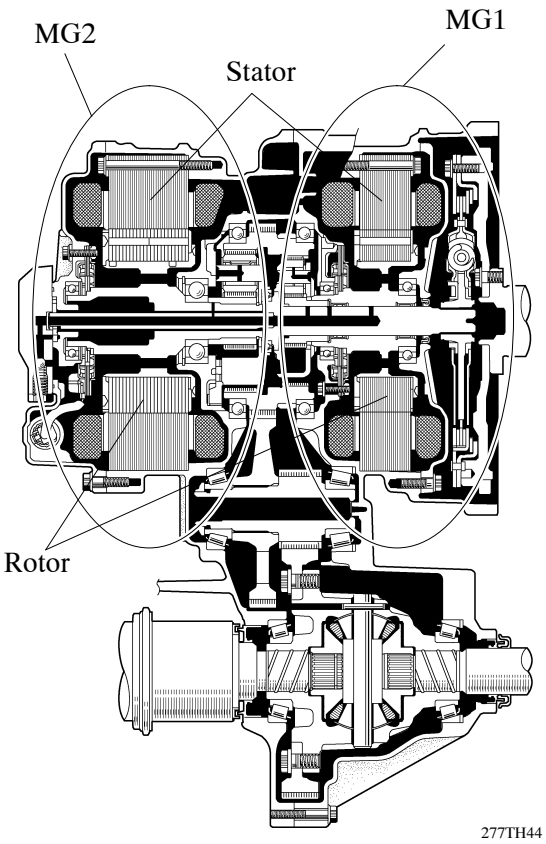


■CONSTRUCTION OF MAIN COMPONENTS

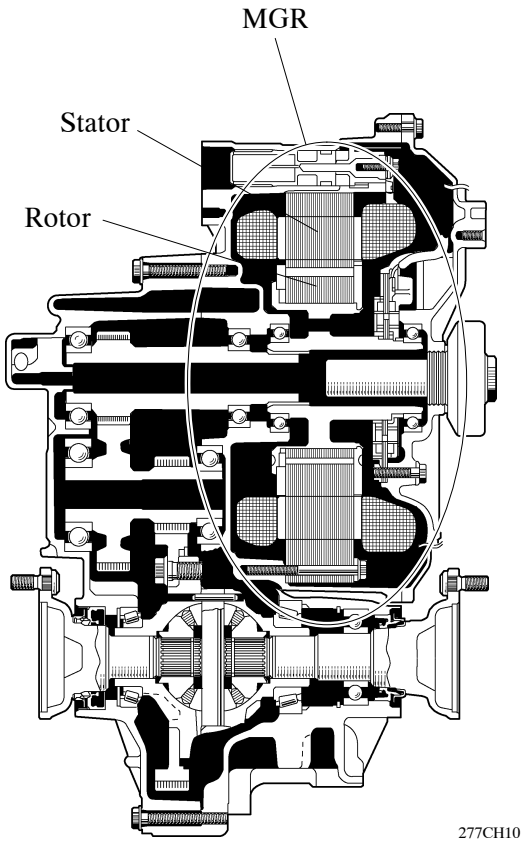
1. MG1, MG2 and MGR

General

- Serving as the source of supplemental motive force that provides power assistance to the engine as needed, the electric motor helps the vehicle achieve excellent dynamic performance, including smooth start-offs and acceleration. When the regenerative brake is activated, MG2 (Motor Generator No. 2) converts the vehicle's kinetic energy into electrical energy, which is then stored in the HV battery.
- MG1 (Motor Generator No. 1) recharges the HV battery and supplies electrical power to drive MG2. In addition, by regulating the amount of electrical power generated (thus varying the generator's rpm), MG1 effectively controls the continuously variable transmission function of the transaxle. MG1 also serves as the starter to start the engine.
- On the 4WD-i system, an MGR (Motor Generator Rear) is provided in the rear drive unit. MGR, which is powered by the electricity from the MG1 or HV battery, drives the rear wheels in accordance with the driving conditions, thus realizing excellent driving stability. During deceleration, MGR functions as a generator, and charges the HV battery as needed.
- Both the MG1, MG2 and MGR are compact, lightweight, and highly efficient alternating current permanent magnet synchronous type.
- Both the MG1 and MG2 use a rotor containing a V-shaped, high-magnetic force permanent magnet that maximizes the generation of reduction torque. They use a stator made of a low core-loss electromagnetic steel sheet and a high voltage resistant winding wire. Through these measures, the MG1 and MG2 have realized high output and torque in a compact construction.
- A cooling system via water pump for the MG1 and MG2 has been added. For details, refer to the cooling system (for Inverter, MG1 and MG2) on page TH-36.



Front Transaxle



Rear Drive Unit (with 4WD-i System Model)

▶ MG1 Specifications ◀

Type	Permanent Magnet Motor
Function	Generate, Engine Starter
Maximum System Voltage*	DC 650 V
Cooling System	Water-cooled

▶ MG2 Specifications ◀

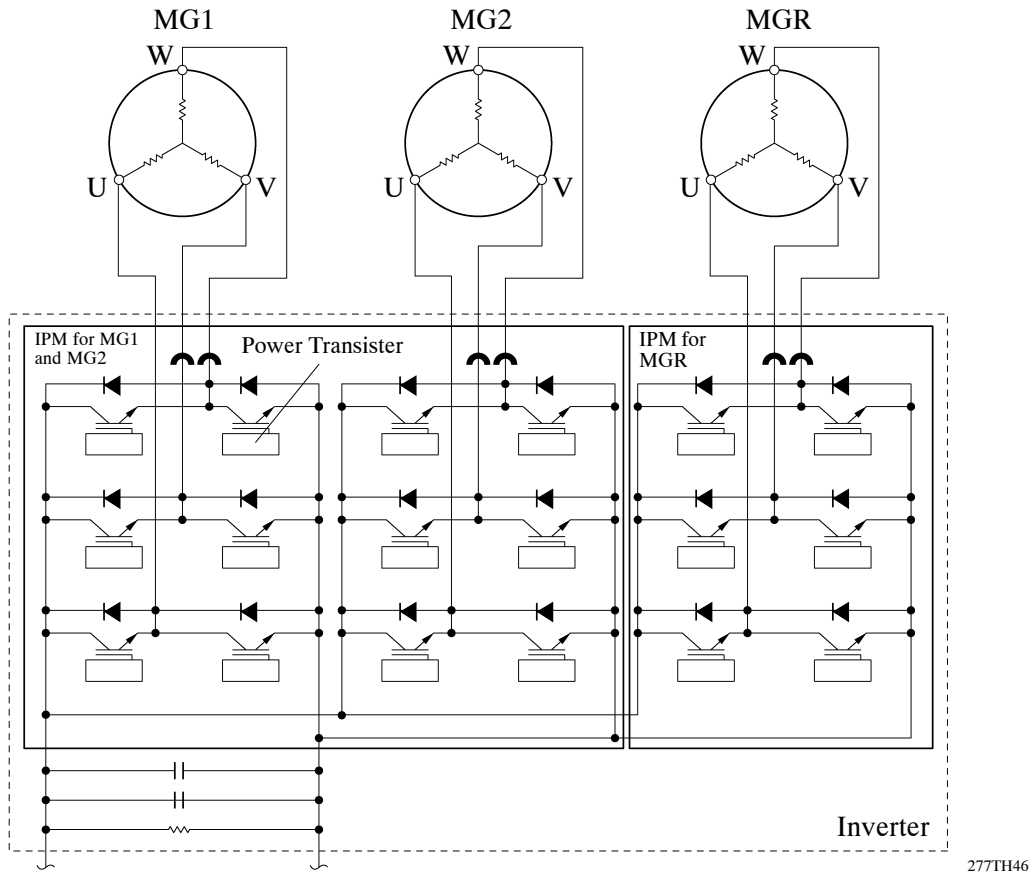
Type	Permanent Magnet Motor
Function	Generate, Drive Front Wheels
Maximum System Voltage*	DC 650 V
Maximum Output	123 kW @ 4,500 rpm (165 HP @ 4,500 rpm)
Maximum Torque	333 N·m @ 0 ~ 1,500 rpm (246 ft·lbf @ 0 ~ 1,500 rpm)
Cooling System	Water-cooled

▶ MGR Specifications ◀

Type	Permanent Magnet Motor
Function	Generate, Drive Rear Wheels
Maximum System Voltage*	DC 650 V
Maximum Output	50 kW @ 4,610 ~ 5,120 rpm (67 HP @ 4,610 ~ 5,120 rpm)
Maximum Torque	130 N·m @ 0 ~ 610 rpm (96 ft·lbf @ 0 ~ 610 rpm)
Cooling System	Air-cooled

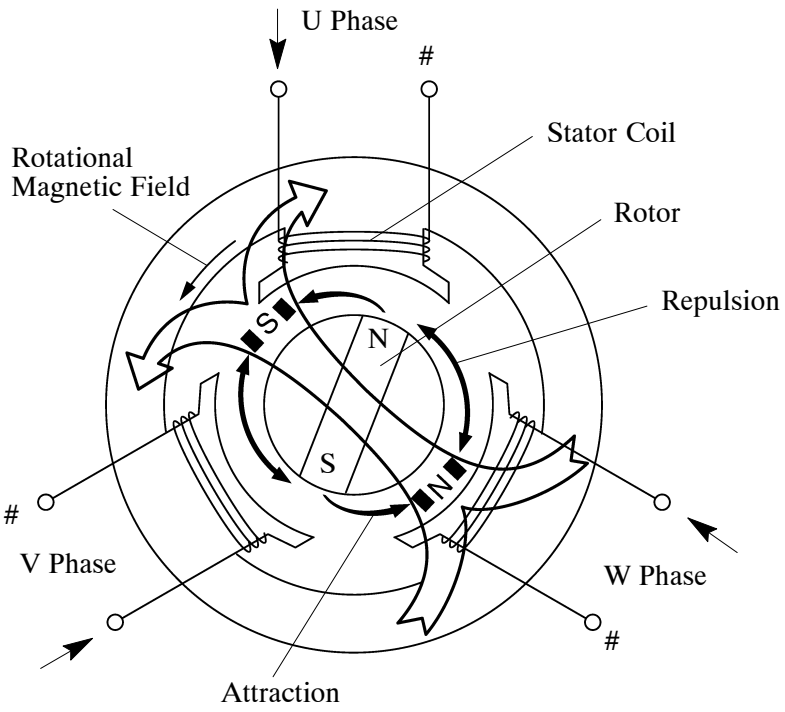
*: These voltage are converted into an alternating current and then supplied to MG1, MG2 and MGR.

▶ System Diagram ◀



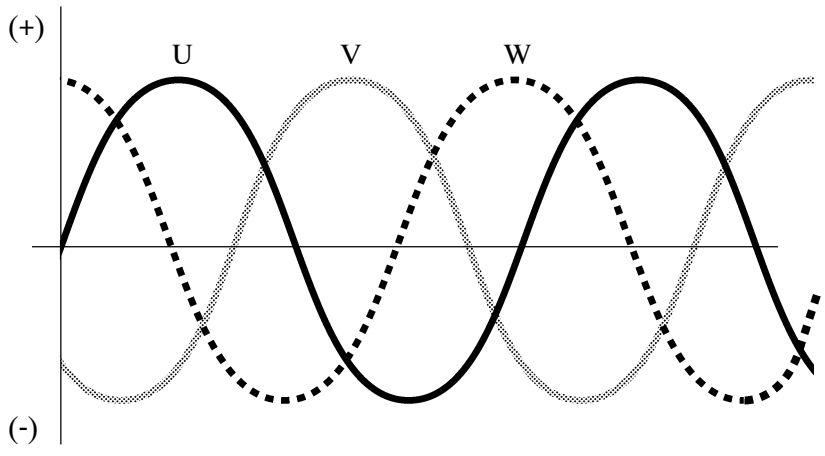
Permanent Magnet Motor (for MG1, MG2 and MGR)

- When a three-phase alternating current is passed through the three-phase windings of the stator coil, a rotational magnetic field is created in the electric motor. By controlling this rotating magnetic field according to the rotor's rotational position and speed, the permanent magnets that are provided in the rotor become attracted by the rotating magnetic field, thus generating torque.
  The generated torque is for all practical purposes proportionate to the amount of current, and the rotational speed is controlled by the frequency of the alternating current.
  Furthermore, a high level of torque, all the way to high speeds, can be generated efficiently by properly controlling the rotating magnetic field and the angles of the rotor magnets.
- When the motor generates electricity, the rotor rotates to create a magnetic field, which creates a current in the stator coil.



182TH29

→ : From inverter
: Connected internally in the motor

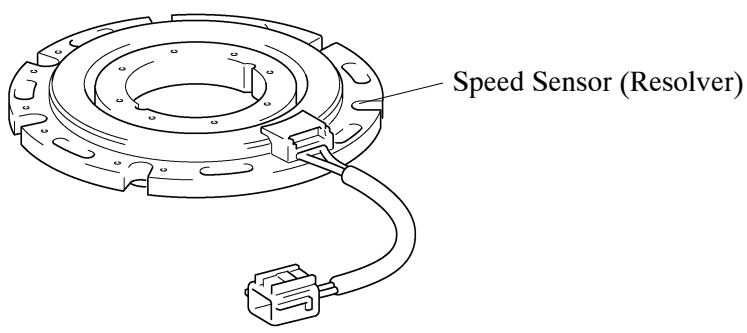


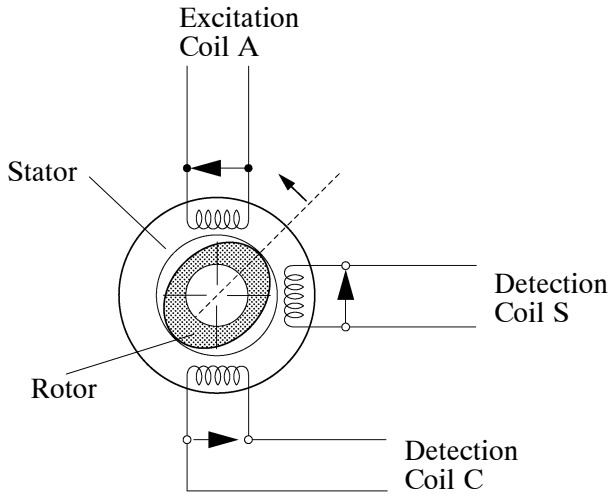
277TH47

Three-phase Alternating Current Output Waveforms

Speed Sensor/Resolver (for MG1, MG2 and MGR)

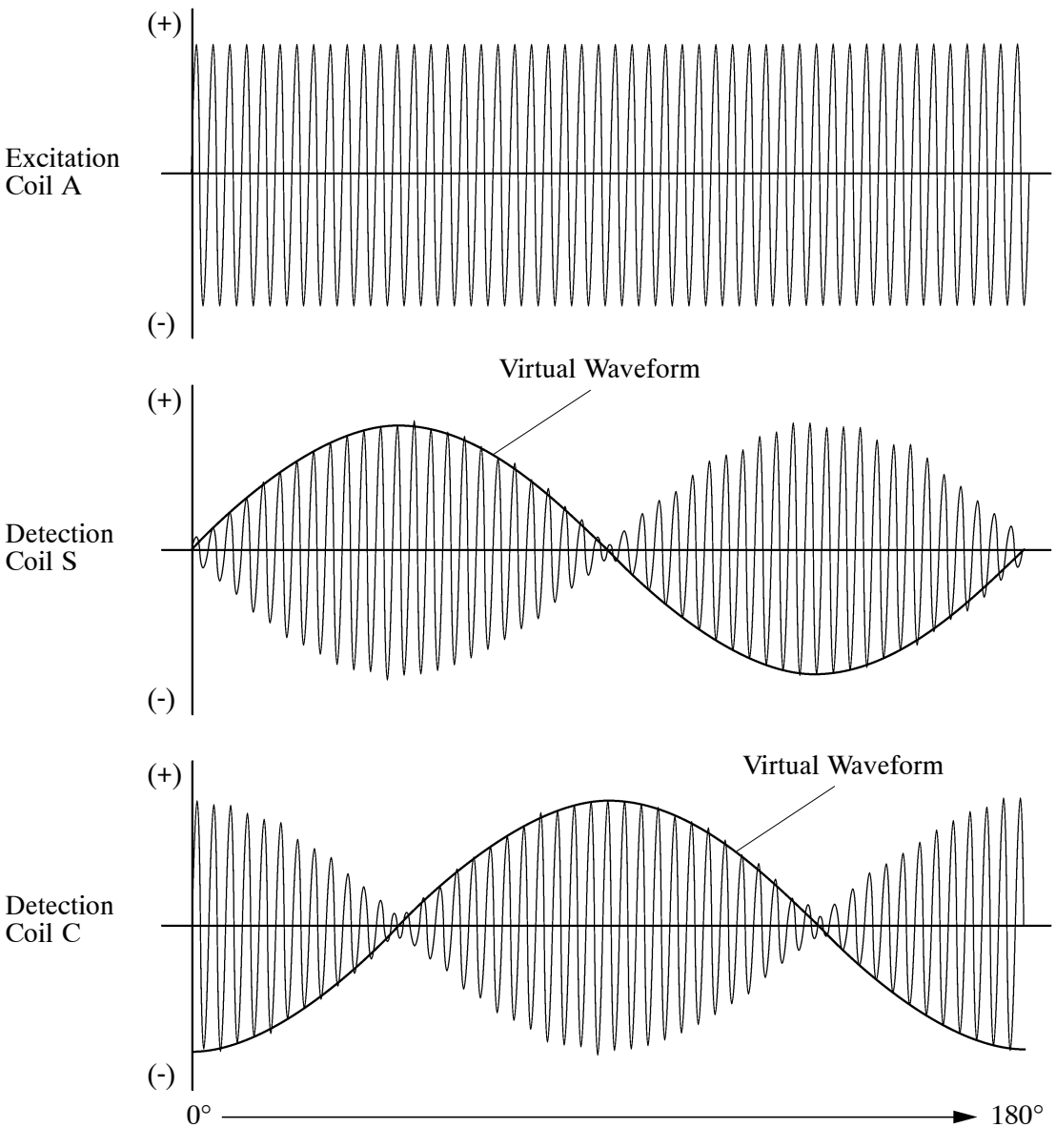
- This is an extremely reliable and compact sensor that precisely detects the magnetic pole position, which is indispensable for ensuring the efficient control of MG1, MG2 and MGR.
- The stator of the sensor contains three types of coils: excitation coil A, detection coil S, and detection coil C. The detection coils S and C are electrically staggered 90 degrees.
  The rotor is oval, the distance of the gap between the stator and the rotor varies with the rotation of the rotor.
- The flow of an alternating current into an excitation coil A results in the output of signals of a constant frequency. Coil S and coil C output values that correspond to the position of the rotor. Therefore, the MG ECU detects the absolute position based on the difference between the coil S and coil C output values. Furthermore, the MG ECU calculates the rotational speed based on the amount of change in the position within a given length of time.





277TH104

- Because an alternating current flows from this resolver to the excitation coil at a constant frequency, a constant frequency is output to the coils S and C, regardless of the rotor speed. The rotor is oval, and the distance of the gap between the stator and the rotor varies with the rotation of the rotor. Consequently, the peak values of the waveforms output by the coils S and C vary in accordance with the position of the rotor.
- The MG ECU constantly monitors these peak values, and connects them to form a virtual waveform. The MG ECU calculates the absolute position of the rotor from the difference between the values of the coils S and C. It determines the rotor direction based on the difference between the phases of the virtual waveform of the coil S and the virtual waveform of the coil C. Furthermore, the MG ECU calculates the rotational speed based on the amount of change in the rotor position within a given length of time.
- The diagrams below illustrate the waveforms that are output at coils A, S, and C when the rotor makes a positive rotation of 180° from a certain position.



277TH105

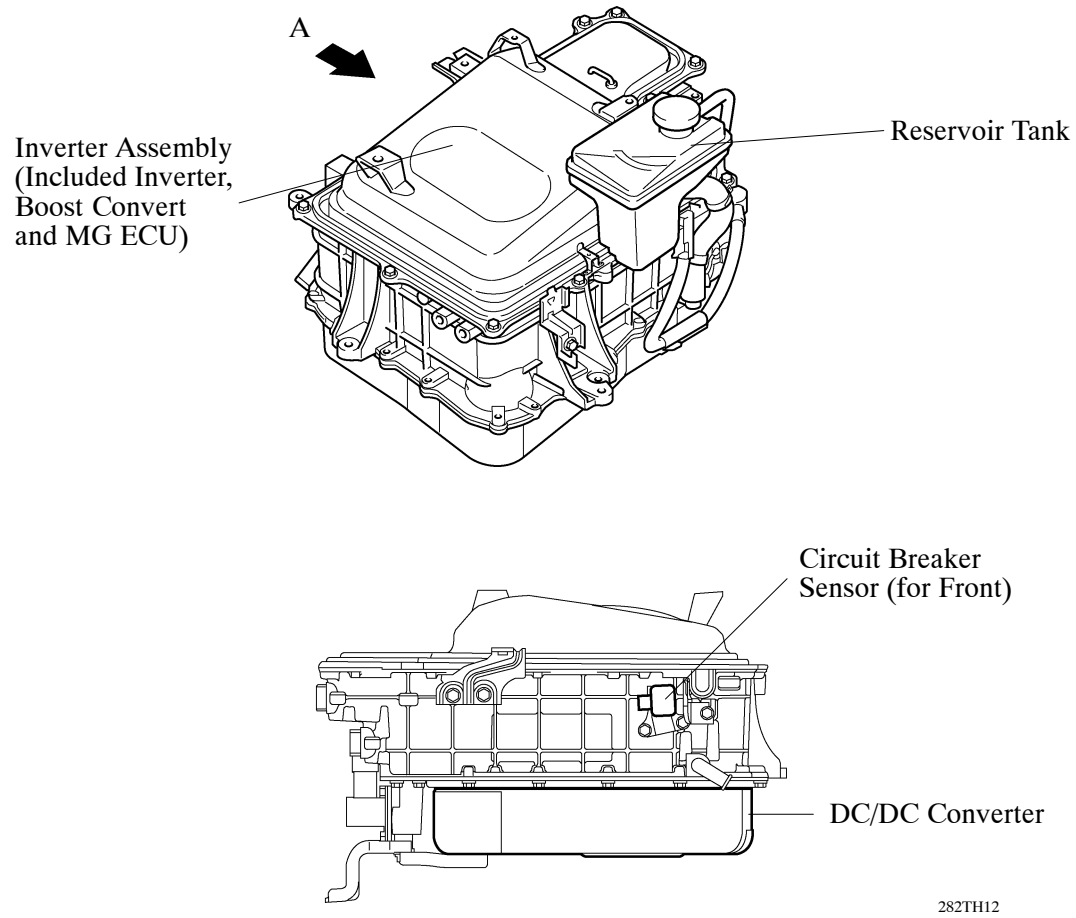
2. Inverter Assembly

General

- The inverter converts the high-voltage direct current of the HV battery into three-phase alternating current for driving MG1, MG2 and MGR*.
- The activation of the power transistors is controlled by the THS ECU, via the MG ECU. In addition, the inverter transmits information that is needed for current control, such as the output amperage or voltage, to the THS ECU via the MG ECU.
- Together with MG1 and MG2, the inverter is cooled by the dedicated radiator of the coolant system that is separate from that of the engine.
- In the event of a collision involving the vehicle, the circuit breaker sensor, which is installed in the inverter, detects a collision signal in order to stop the system. For details, refer to During Collision Control on page TH-61.
- A boost converter is used in the inverter assembly, in order to boost the nominal voltage output by the HV battery from DC 288 V to maximum voltage of DC 650 V. After the voltage is boosted, the inverter converts the direct current into an alternating current.
- Each of the bridge circuits for MG1, MG2, and MGR* contains 6 power transistors. In addition, a signal processor/protective function processor has been integrated into a compact IPM (Intelligent Power Module) for driving the vehicle.
- A radiator that integrates an inverter radiator and engine radiator is used to optimize the space it occupies.

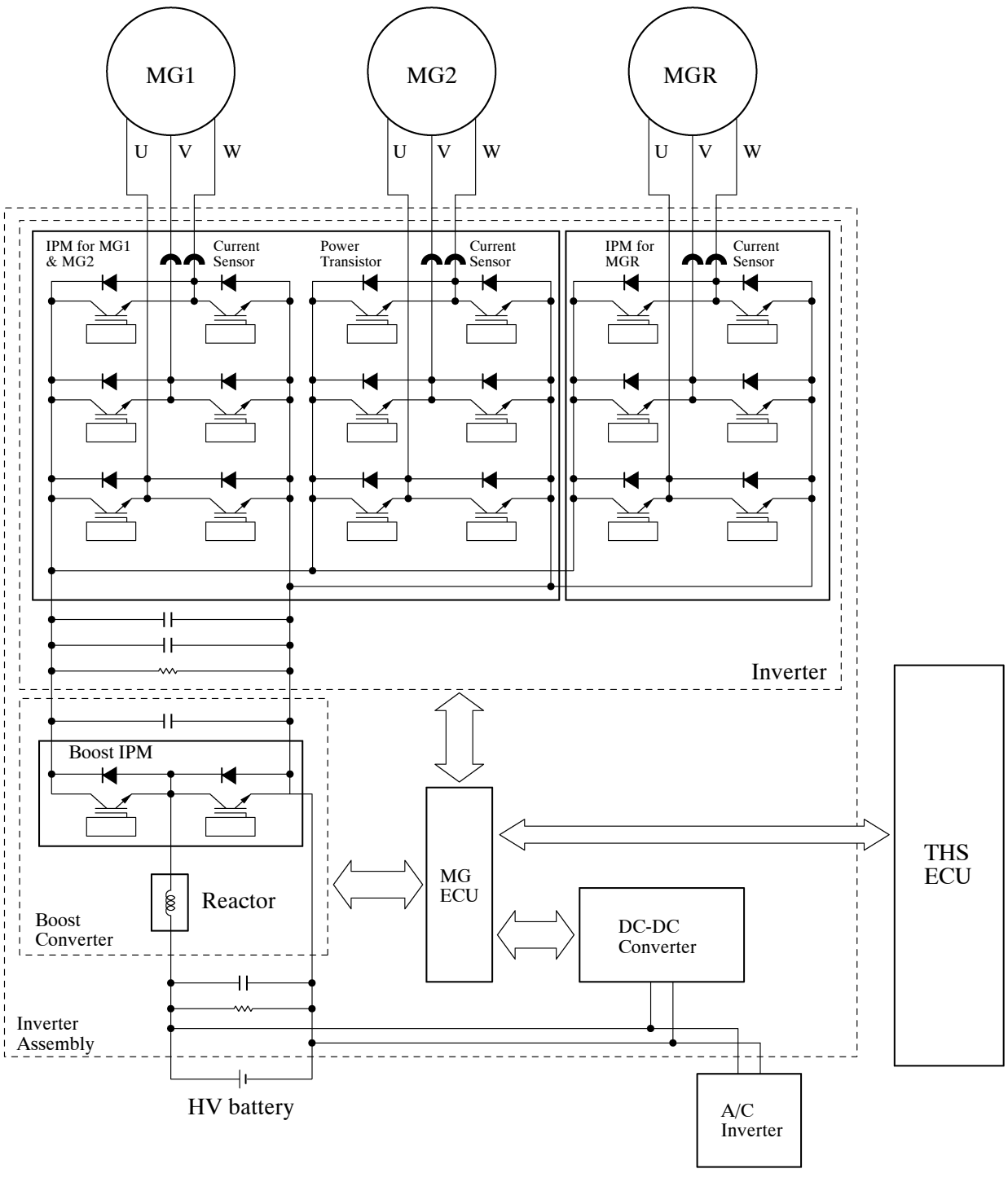
For details on the multiple functions of the inverter, refer to Inverter Assembly Control on page TH-56.

*: Only on models with 4WD-i system



View from A

▶ System Diagram ◀

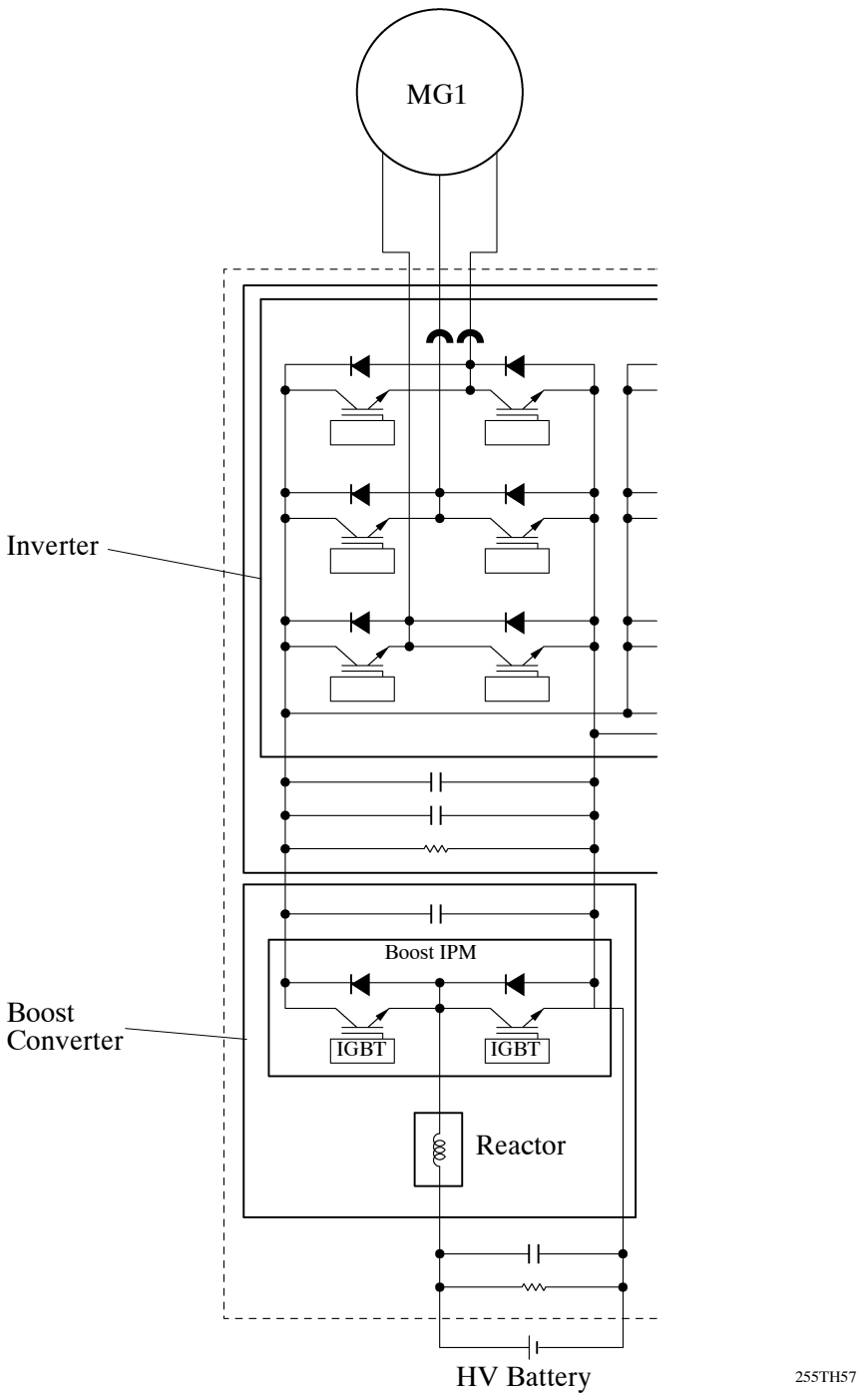


277TH56

Boost Converter

- This boost converter boosts the nominal voltage of DC 288 V that is output by the HV battery to the maximum voltage of DC 650 V. The converter consists of the boost IPM (Intelligent Power Module) with a built-in IGBT (Insulated Gate Bipolar Transistor) which performs the switching control, and the reactor which stores energy. By using these components, the converter boosts the voltage. For details, refer to Inverter Assembly Control on page TH-56.
- When MG1, MG2 or MGR acts as the generator, the inverter converts the alternating current into the maximum voltage of DC 650 V, and then the boost converter reduces the voltage to the nominal voltage of DC 288 V, thus the HV battery is charged.

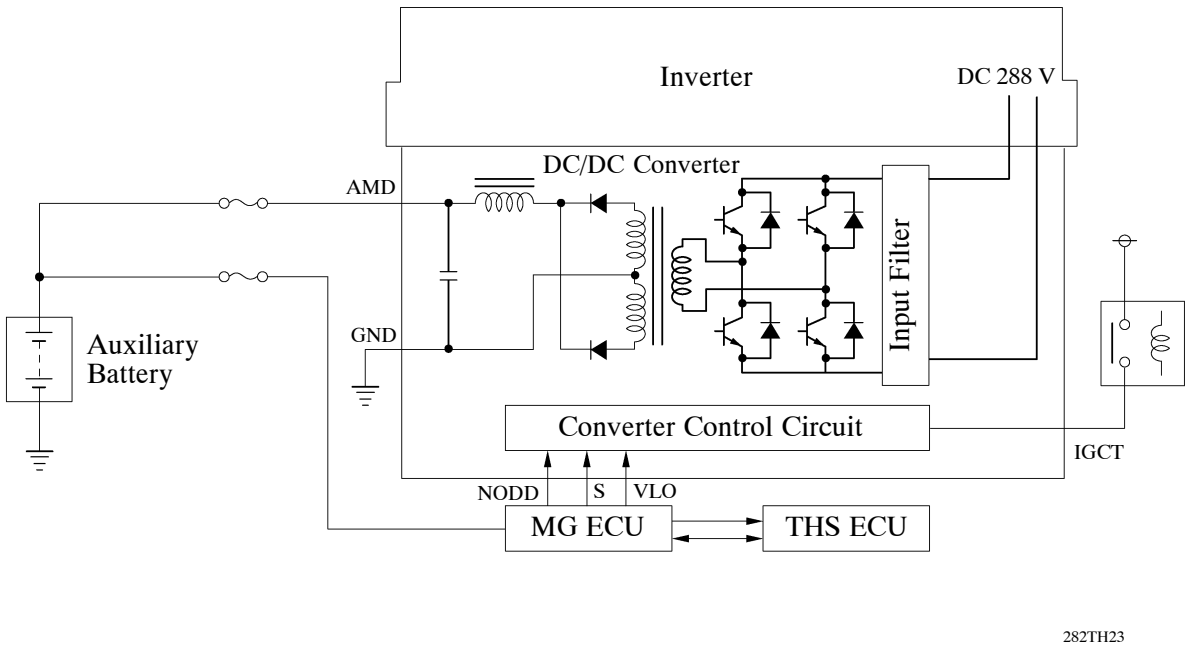
▶ System Diagram ◀



DC/DC Converter

The power source for auxiliary equipment of the vehicle such as the lights, audio system, and the air conditioning system (except A/C compressor), as well as the ECUs, is based on a DC 12 V system. Because the THS-II generator outputs at nominal voltage of DC 288 V, the converter is used to transform the voltage from DC 288 V to DC 12 V in order to recharge the auxiliary battery. The converter is installed on the underside of the inverter.

▶ System Diagram ◀

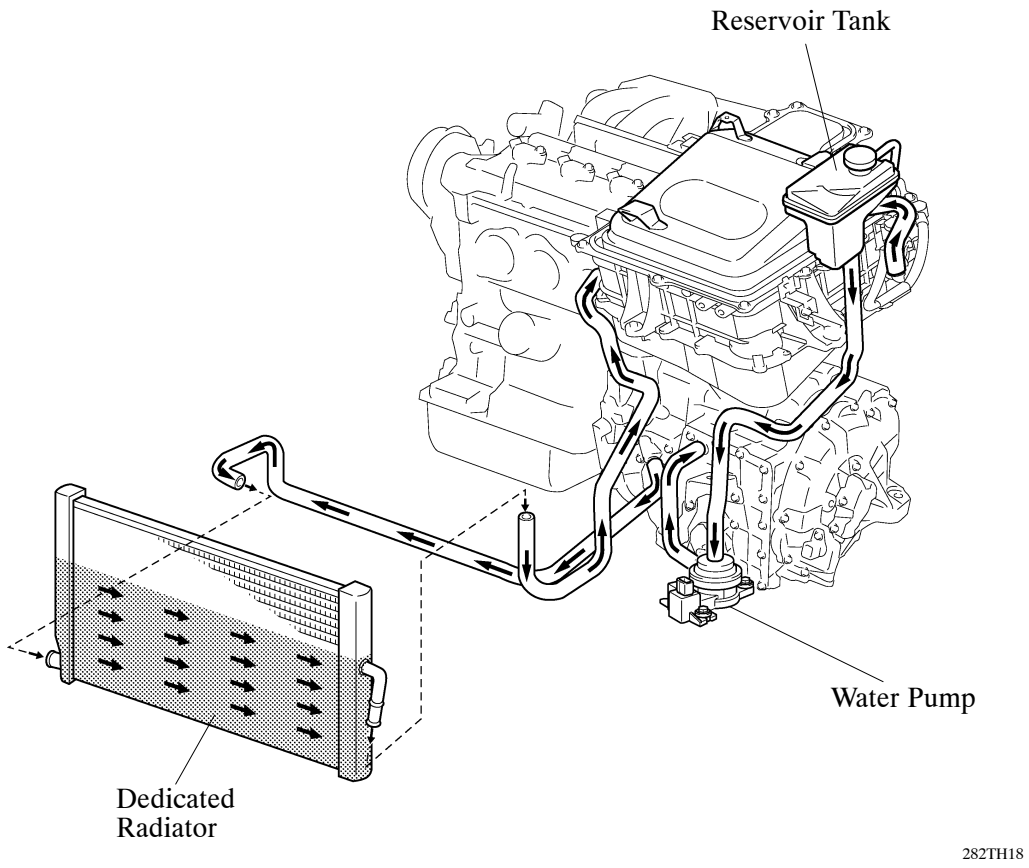


MG (Motor Generator) ECU

- The MG ECU is provided in the inverter assembly. In accordance with the signals received from the THS ECU, the MG ECU controls the inverter and boost converter in order to drive MG1, MG2, or MGR or cause them to generate electricity. Furthermore, the MG ECU controls the DC-DC converter in accordance with the signals received from the THS ECU.
- The MG ECU transmits information that is required for vehicle control, such as the inverter output amperage, inverter temperature, and failure information, to the THS ECU. It receives information that is required for controlling the motor generator, such as the required motive force or the motor temperature, from the THS ECU.

3. Cooling System (for Inverter, MG1 and MG2)

- A cooling system that is independent from the engine cooling system has been provided for cooling the inverter, MG1, and MG2.
- This cooling system activates when the power supply status is switched to READY ON state.
- The radiator for the cooling system is integrated with the radiator for the engine. Accordingly, the radiator has been simplified and the space it occupies has been optimized.



▶ Specifications ◀

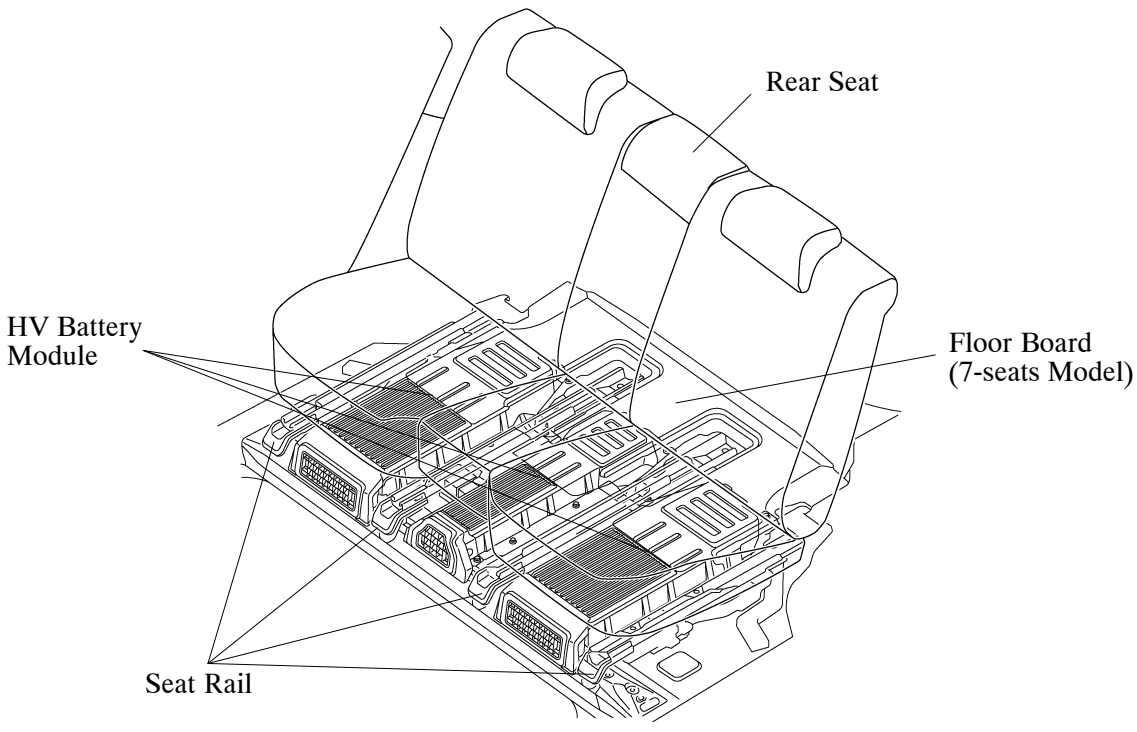
Water Pump	Discharge Volume liter/min.		12 or above (65°C (149°F))
Coolant	Capacity liters (US qts, Imp. qts)		3.4 (3.6, 3.0)
	Type		TOYOTA Genuine Super Long Life Coolant (SLLC) or Equivalent
	Color		Pink
	Maintenance Intervals	First Time	100,000 mile (160,000 km)
		Subsequent	Every 50,000 mile (80,000 km)

- SLLC is pre-mixed (50% coolant and 50% deionized water), so no dilution is needed when adding or replacing SLLC in the vehicle.

4. HV Battery

General

- The ’06 Highlander hybrid model uses a sealed nickel metal hydride (Ni-MH) batteries for the HV battery. This HV battery has a high power density, it is lightweight, and it offers longevity to match the characteristics of the THS-II system. Because the THS-II system effects charge/discharge control to maintain the HV battery at a constant level of SOC (state of charge) while the vehicle is operating normally, it does not rely on the use of external recharges.
- The HV battery uses nickel-plated, metal container type cells to realize enhanced cooling performance and a compact construction. As a result, high power density, lightweight, and longevity have been realized at high levels.
- The HV battery consists of 240 cells (8 cells × 30 modules) with a nominal voltage of 288V (240 cells × 1.2V).
  The HV battery module, which is mounted under the rear seat, is split into three portions separated by the seat rails.
- A battery module consists of 30 modules that are connected in series by a bus bar module. Furthermore, the connection between cells is made at two locations in order to reduce internal resistance and improve efficiency.
- A junction block, in which an SMR (System Main Relay), resistor, and a current sensor are integrated, and a battery smart unit that monitors the HV battery, have been located optimally under the rear seat in the same way as the HV battery.
- The THS ECU controls the operation of the cooling fan in order to ensure the proper performance of the HV battery, which is subjected to the heat that is created while the HV battery is being charged and discharged. One cooling fan is provided for each portion of the HV battery modules, which are split into three sections. A cooling system that uses the air in the cabin is used.
- A service plug that shuts off the circuit is provided in the middle of the 30 modules (Between No.12 module and No.13 module). Before servicing any portion of the high-voltage circuit, make sure to remove the service plug.

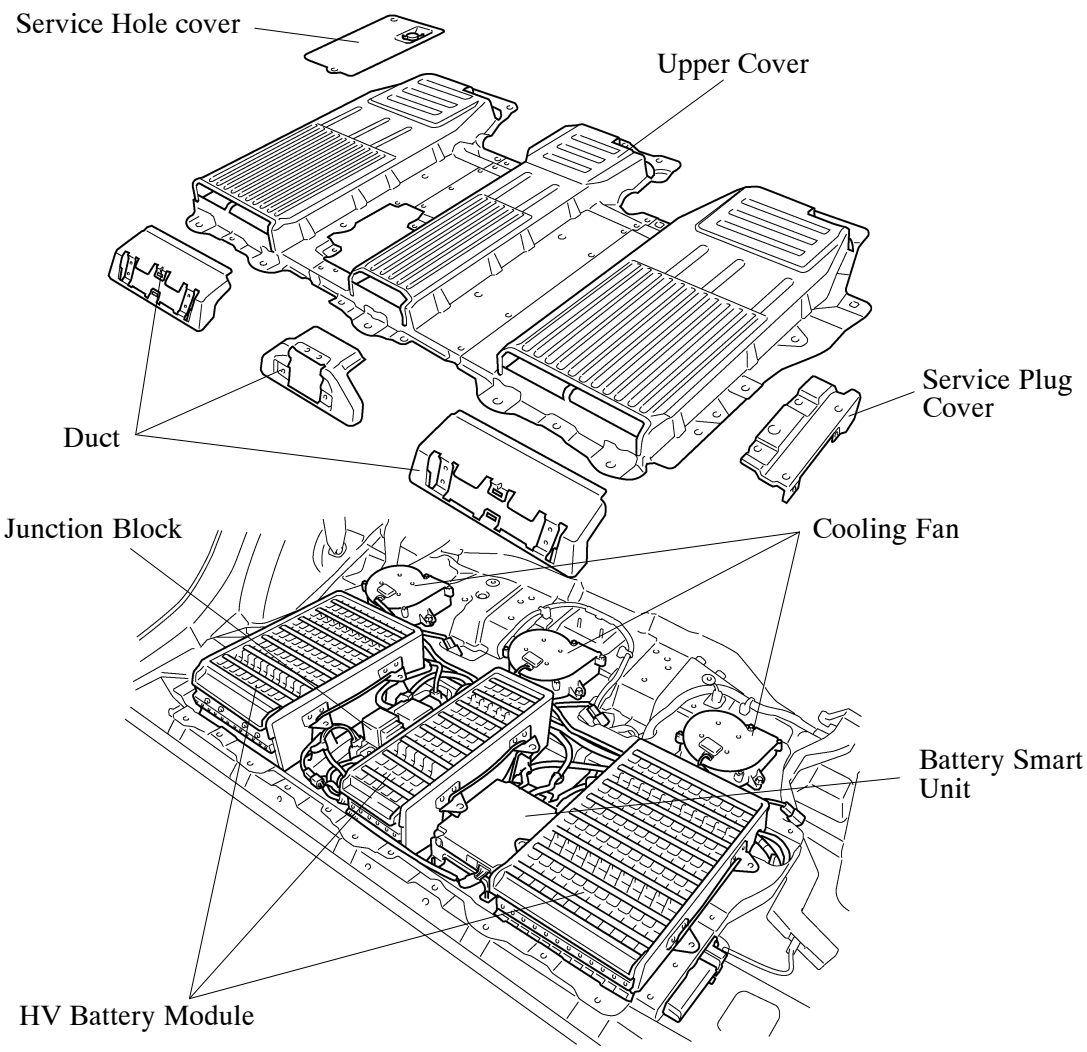


282TH03

▶ Battery Specifications ◀

Type	Sealed Nickel Metal Hydride Battery
Cell Quantity	240 cells (8 cells × 30 Modules)
Cell Type	Nickel Plated Metal Container
Nominal Voltage	288 V

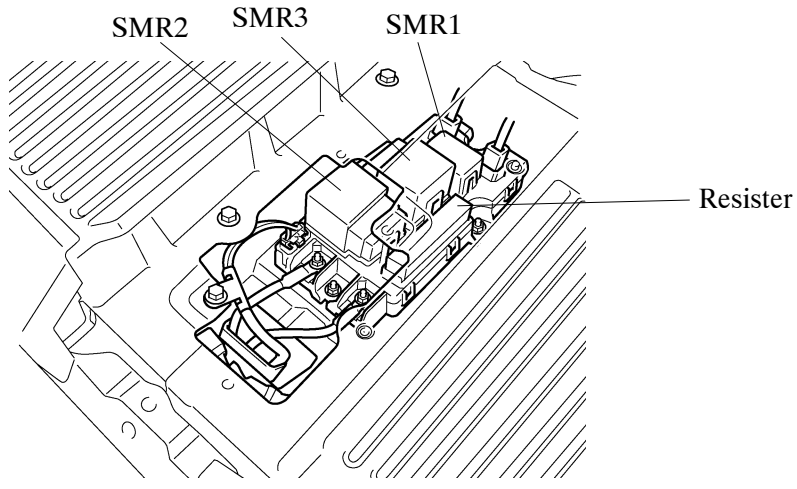
Layout of Main Components



282TH04

Junction Block

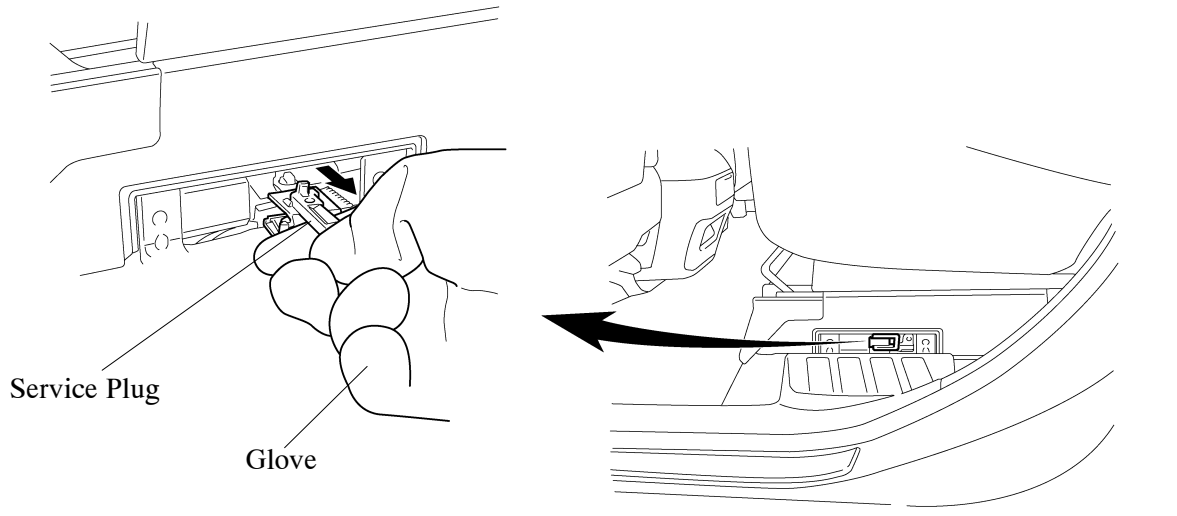
- A junction block, in which an SMR (System Main Relay), resistor, and a current sensor are integrated, is used.
- This junction block is mounted via a rubber damper in order to absorb the vibrations that are created by the SMR during operation.



277TH98

Service Plug

By removing the service plug before performing any inspection or service, the high-voltage circuit is shut off at the intermediate position of the HV battery, thus ensuring safety during service.
The service plug assembly contains a reed switch for interlock. Lifting the clip lock up turns OFF the lead switch, which shuts off the SMR. However, to ensure safety, make sure to turn OFF the ignition switch before removing the service plug.
The main fuse for the high-voltage circuit is provided inside of the service plug assembly.
For further details on how to handle the service plug and other safety cautions, refer to the 2006 Highlander Repair Manual (Pub. No. RM1145U).



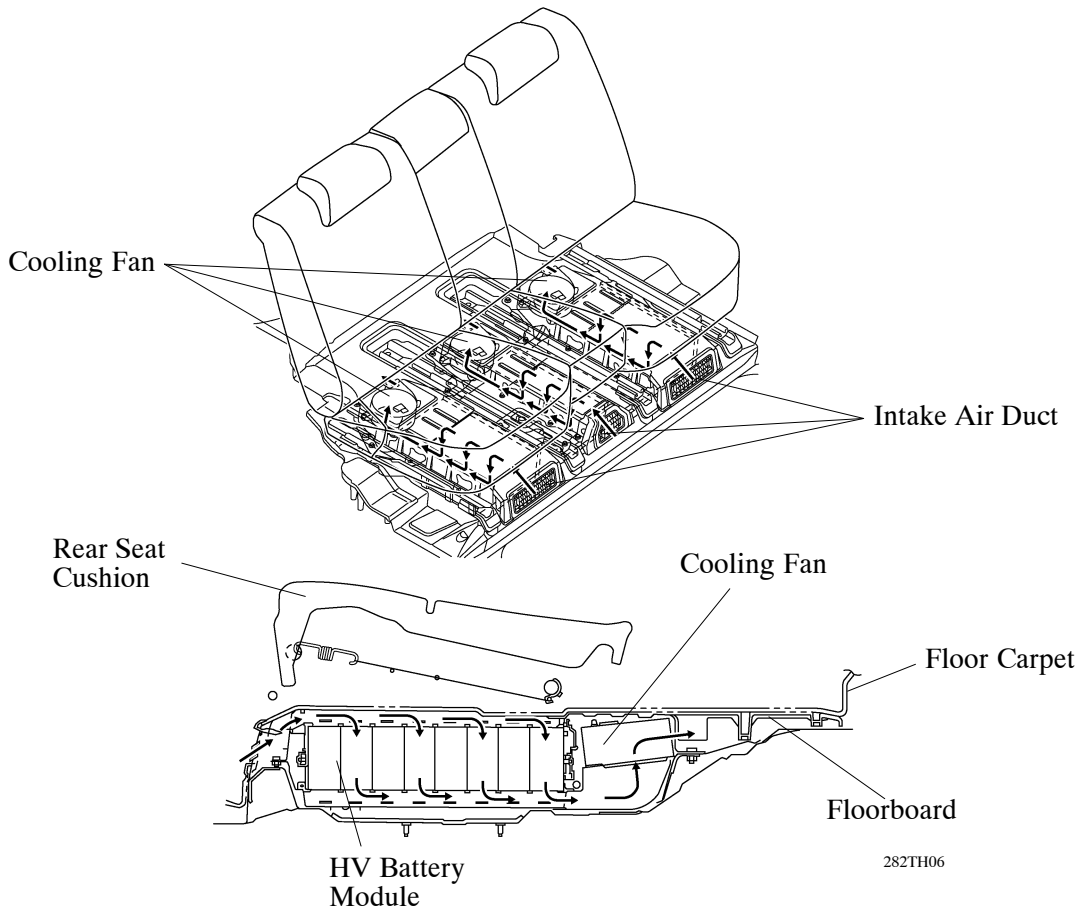
282TH05

Service Tip

After the service, please do not start the system until the service plug is connected.
The battery smart unit may break down.

HV Battery Cooling System

- To ensure the proper performance of the HV battery while it generates heat during the repetitive charge and discharge cycles, a dedicated cooling system for the HV battery is used.
- One cooling fan is provided for each portion of the HV battery modules, which are split into three portions. Because each of the three cooling fans has been made compact, the overall operating sound has been reduced. Furthermore, because the cooling fans are mounted via rubber dampers, this construction also contributes to noise reduction.
- The cabin air that is drawn in from the intake air ducts underneath the rear seat flows from above the battery modules to below, thus lowering the temperature of the battery modules. Then, it passes from the back and through the space below the floorboard, and flows inside the cabin or is discharged outside of the vehicle.
- The THS ECU controls the operation of the cooling fan. The THS ECU receives the signals from the battery temperature sensor, which is built into the HV battery via the battery smart unit. Then, it controls the cooling fan in order to control the battery temperature at an appropriate level. For details, refer to THS ECU Control on page TH-47.

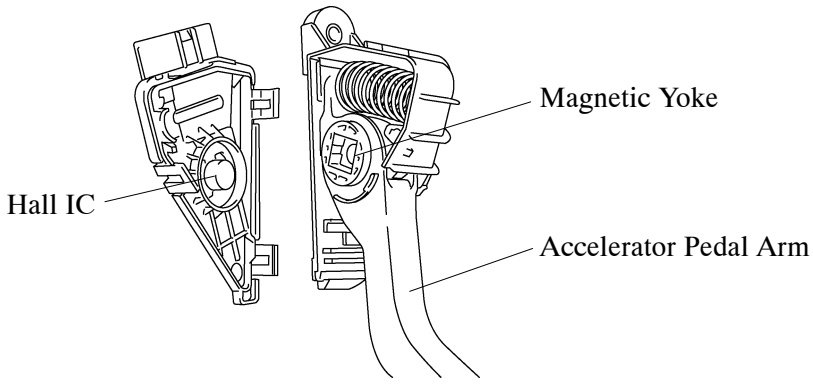


▶ Cooling Fan Specifications ◀

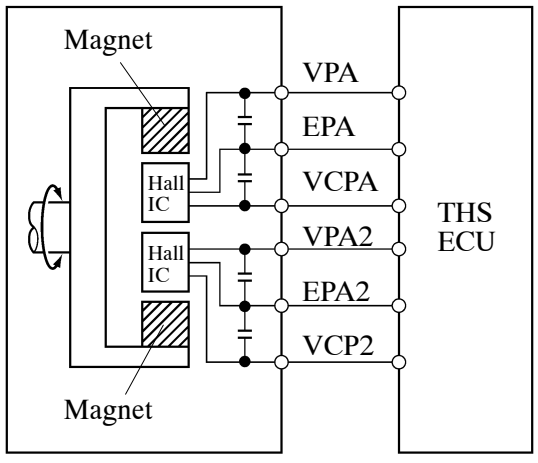
Type		Radial Fan
Motor Type		DC Motor (without Brush)
Air Flow Volume	m^3/h	Step-less Control
		83
Fan Speed	rpm	Max. 3,400
Power Consumption	W	17 or less

5. Accelerator Pedal Position Sensor

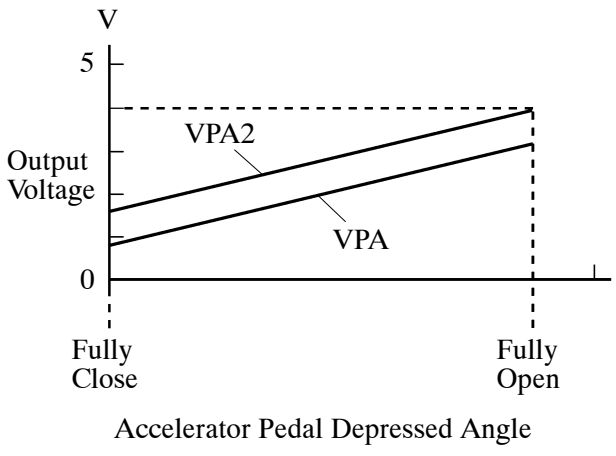
The magnetic yoke that is mounted at the base of the accelerator pedal arm rotates around the Hall IC in accordance with the amount of effort that is applied to the accelerator pedal. The Hall IC converts the changes in the magnetic flux that occur at that time into electrical signals, and outputs them in the form of accelerator pedal effort to the THS ECU.



228TU23



228TU24



228TU25

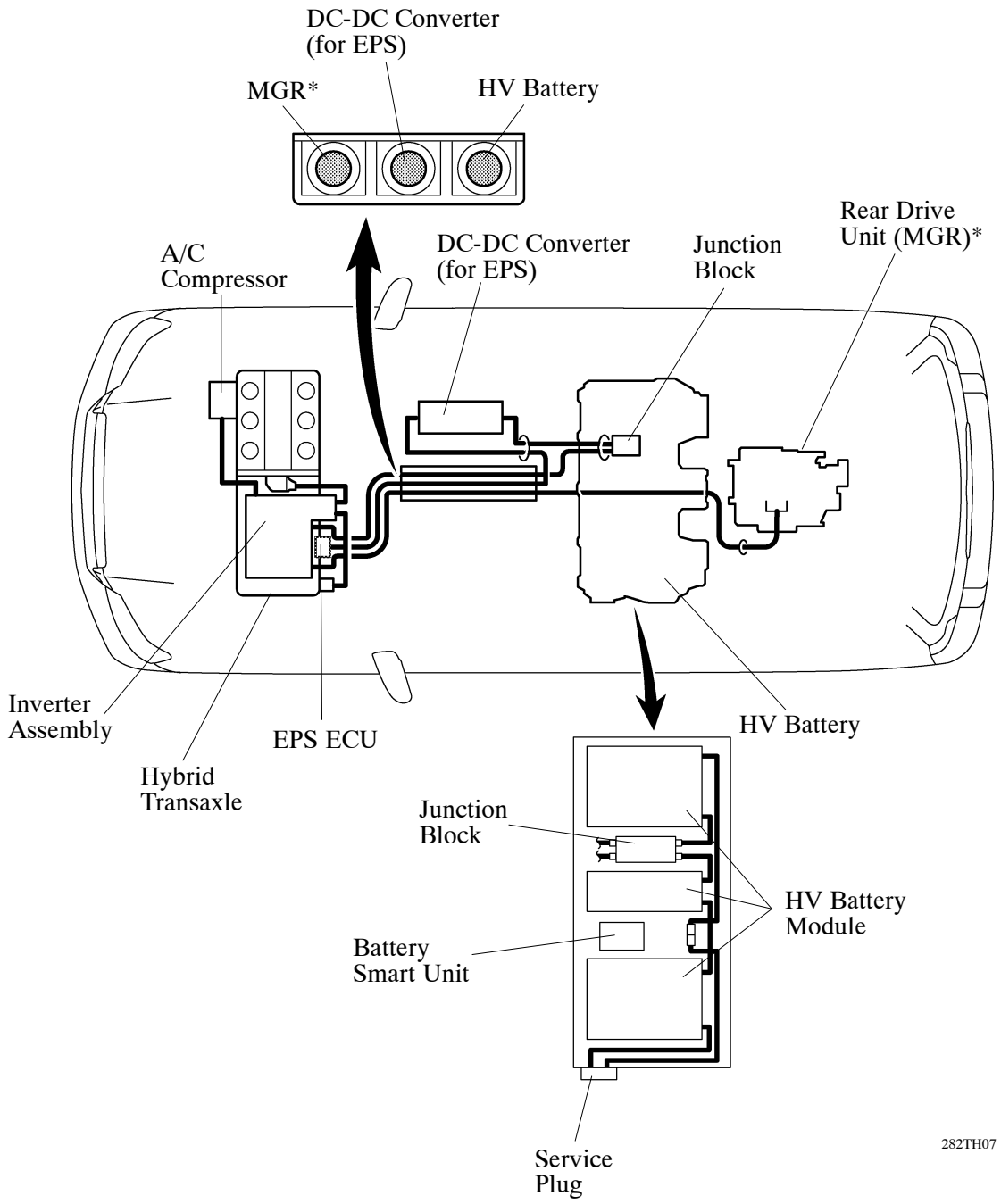
Service Tip

The inspection method differs from the conventional accelerator pedal position sensor because this sensor uses a hall IC. For details, refer to the 2006 Highlander Repair Manual (Pub. No. RM1145U).

6. Power Cable

The power cable is a high-voltage, high-amperage cable that connects the HV battery with the inverter, the inverter with MG1, MG2 and MGR*, and inverter with A/C compressor. The power cable starts at the connector of the junction block of the HV battery assembly, which is located under the rear seat. It passes under the floor panel, along the side of the floor reinforcement, and connects to the inverter in the engine compartment. The power cable is made of a shielded cable in order to reduce electromagnetic interference. For identification purposes, the high-voltage wiring harness and connectors are color-coded orange to distinguish them from those of the ordinary low-voltage wiring.

*: Only on models with 4WD-i system



*: Only on models with 4WD-i system

■THS-II CONTROL SYSTEM

1. General

The THS-II control system contains the following components.

Item	Outline
THS ECU Control (See page TH-47)	• The THS ECU calculates the target motive force based on the shift position, the degree to which the accelerator pedal is depressed, and the vehicle speed. It effects control in order to create the target motive force by optimally combining MG1, MG2, and the engine. • The THS ECU calculates the engine motive force based on the target motive force, which has been calculated based on the requirements of the driver and the conditions of the vehicle. In order to create this motive force, the THS ECU appropriately controls the ETCS-i (Electronic Throttle Control System-intelligent) system, fuel injection volume, injection timing, and VVT-i (Variable Valve Timing-intelligent) system. • The THS ECU monitors the SOC of the HV battery and the temperature of the HV battery, MG1, and MG2, in order to optimally control these items. • The THS ECU effects monitor control to monitor the conditions of the HV battery and cooling fan control to keep the HV battery at a predetermined temperature. Thus, it optimally controls these components. • When the shift position is in the N position, the THS ECU effects shut down control to electrically stop MG1 and MG2. • If the drive wheels rotate without traction, the THS ECU performs the motor traction control that provides a restraint on a rotation of MG2, in order to protect the planetary gear unit and prevent MG1 from generating excessive electricity. • For the purpose of protecting the circuit from high voltage and ensuring the reliability of the circuit shut down, the THS ECU effects SMR control through the use of 3 relays to connect and shut down the high-voltage circuit. • The THS ECU calculates the SOC by estimating the charging and discharging amperage of the HV battery, in order to effect condition control. • The THS ECU uses the temperature sensor that is provided in the HV battery to monitor the temperature of the HV battery and controls its temperature by optimally controlling the three cooling fans that are provided.
MG1, MG2 and MGR* Main Control (See page TH-54)	• MG1, which is driven by the engine, generates high voltage (alternating current) in order to operate MG2 and charge the HV battery. Also, it functions as a starter to start the engine. • MG2, which is driven by electrical power from MG1 or the HV battery, generates a motive force for the front wheels. • MGR*, which is driven by the electrical power from the HV battery, generates a motive force for the rear wheels. • MG2 and MGR* generate electricity to charge the HV battery (regenerative brake control) during braking, or when the accelerator pedal is not being depressed. • Speed sensors (resolvers) detect the speed and the rotor position of MG1, MG2, and MGR*, and output them to the THS ECU via the MG ECU. • A temperature sensor mounted on MG1, MG2 and MGR* detects the temperature and transmits it to the THS ECU.

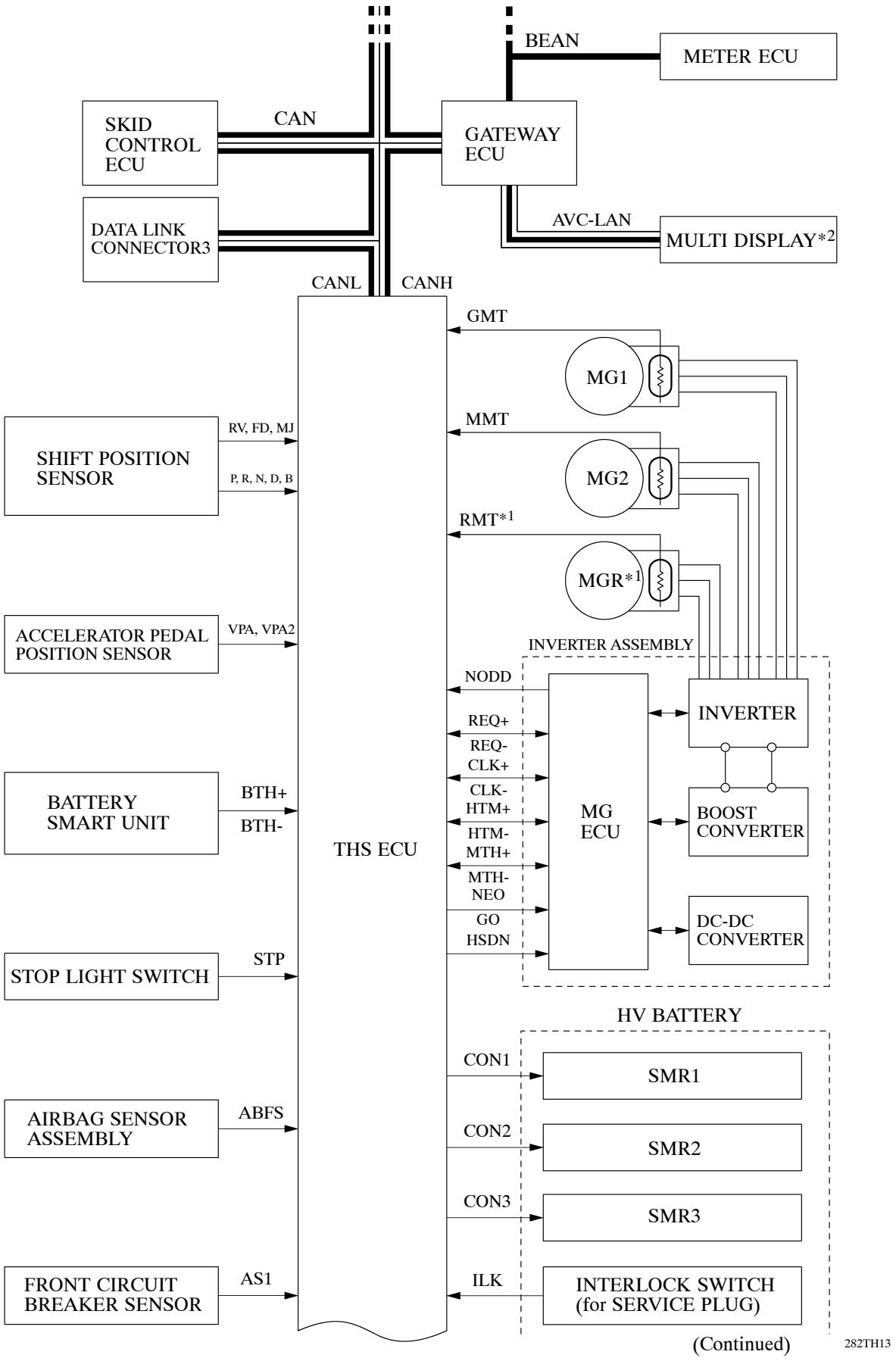
(Continued)

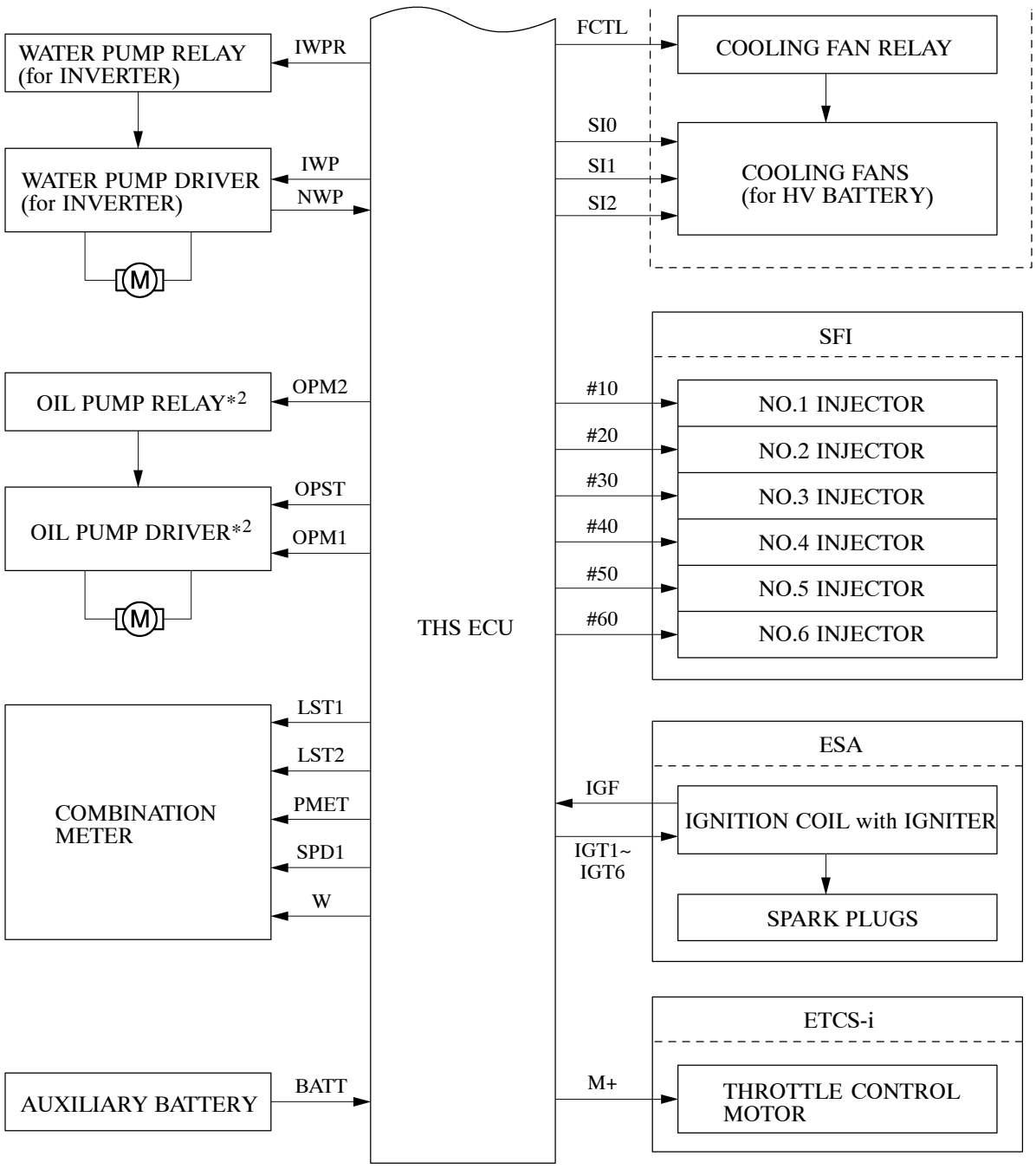
Item		Outline
Inverter Assembly Control (See page TH-56)		• The inverter converts the direct current from the HV battery into an alternating current for MG1 and MG2, or vice versa, in accordance with the signals provided by the THS ECU via the MG ECU. In addition, the inverter supplies the alternating current from the MG1 power to the alternating current for MG2. • Via the MG ECU, the THS ECU sends the signal to the power transistor in the inverter for switching the U, V, and W phases of MG1 and MG2, in order to drive MG1 and MG2. • The THS ECU shuts down if it receives an overheating, over-current, or fault voltage signal from the inverter.
	Boost Converter Control	• The boost converter boosts the HV battery nominal voltage of DC 288V up to a maximum voltage of DC 650V, in accordance with the signals provided by the THS ECU via the MG ECU. • The inverter converts the alternating current generated by MG1 or MG2 into a direct current. The boost converter drops the DC 650V to DC 288V (for the HV battery) in accordance with the signals provided by the THS ECU via the MG ECU.
	DC-DC Converter Control	• Drops the nominal voltage of DC 288 V into DC 12 V in order to supply electricity to body electrical components, as well as to recharge the auxiliary battery (DC 12 V). • This converter controls the voltage of the auxiliary battery to a constant voltage.
Skid Control ECU Control (See page TH-59)		During braking, the skid control ECU calculates the required regenerative brake force and transmits it to the THS ECU. Upon receiving this signal, the THS ECU transmits actual regenerative brake control value to the skid control ECU. Based on this result, the skid control ECU calculates and executes the required hydraulic pressure brake force.
Battery Smart Unit Control (See page TH-60)		The battery smart unit monitors the voltage, current, temperature of the HV battery, and the voltage of the cooling fan and transmits them to the THS ECU.
Shift Control (See page CH-12)		The THS ECU detects the shift position (P, R, N, D, or B) in accordance with the signal provided by the shift position sensor, and controls MG1, MG2, and the engine, in order to create the driving conditions that suit the selected shift position.
During Collision Control (See page TH-61)		During a collision, if the THS ECU receives an airbag deployment signal from the airbag sensor assembly or an actuation signal from the circuit breaker sensor located in the inverter, it turns OFF the SMR (System Main Relay), in order to shut off the entire power supply.
Cruise Control System Operation Control		When the cruise control ECU that is enclosed in the THS ECU receives a cruise control switch signal, it regulates the motive forces of the engine, MG1 and MG2 to be an optimum combination in order to obtain the targeted vehicle speed by a driver's demand.
Indicator and Warning Light Illumination Control (See page TH-63)		Illuminates or blinks the lights to inform the driver of the vehicle conditions or system malfunctions.
Diagnosis (See page TH-65)		When the THS ECU detects a malfunction, the THS ECU diagnosis and memorizes the values corresponding to the failure.
Fail-Safe (See page TH-65)		When the THS ECU detects malfunction, the THS ECU stops or controls the actuator and ECUs according to the data already stored in memory.

*: Only on models with 4WD-i system

2. Construction

The configuration of the THS-II control system in the ’06 Highlander hybrid model is shown in the following chart.





277TH64

*1: Only on models with 4WD-i system
*2: Optional equipment

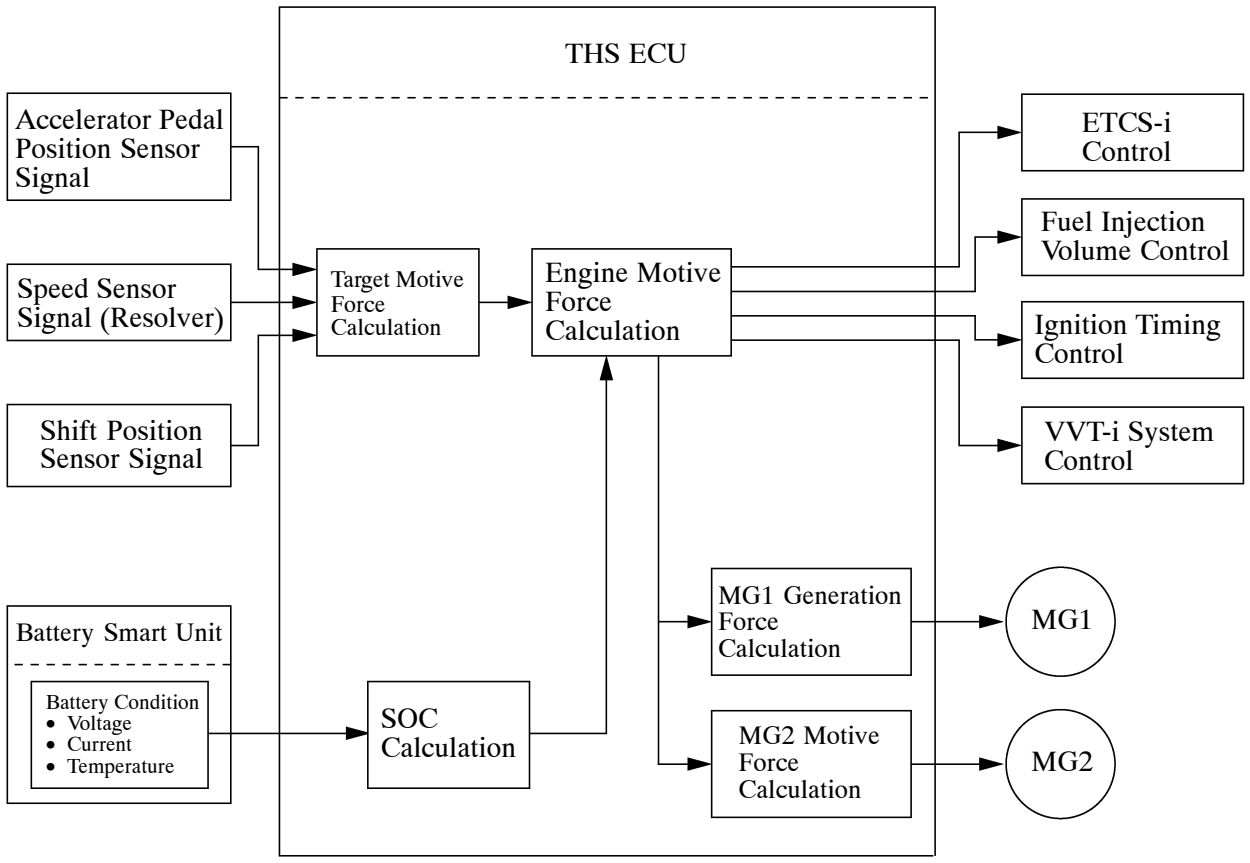
3. THS ECU Control

General

- The THS ECU detects the amount of effort applied to the accelerator pedal in accordance with the signals provided by the accelerator pedal position sensor. The THS ECU receives signals from the speed sensor (resolver) in the MG1 and MG2, and detects the shift position signal from the shift position sensor. The THS ECU determines the driving conditions of the vehicle in accordance with these pieces of information, and optimally controls the motive forces of MG1, MG2, and the engine. Furthermore, the THS ECU optimally controls the output and torque of these motive forces in order to realize lower fuel consumption and cleaner exhaust emissions.
- The THS ECU calculates the engine motive force based on the calculated target motive force, and by taking the SOC and the temperature of the HV battery into consideration. The value obtained by subtracting the engine motive force from the target motive force is the MG2 motive force.
- The THS ECU realizes the required engine motive force by properly effecting ETCS-i control, fuel injection volume control, injection timing control, and VVT-i system control. Furthermore, the THS ECU appropriately operates MG1 and MG2 in order to realize the required MG2 motive force.

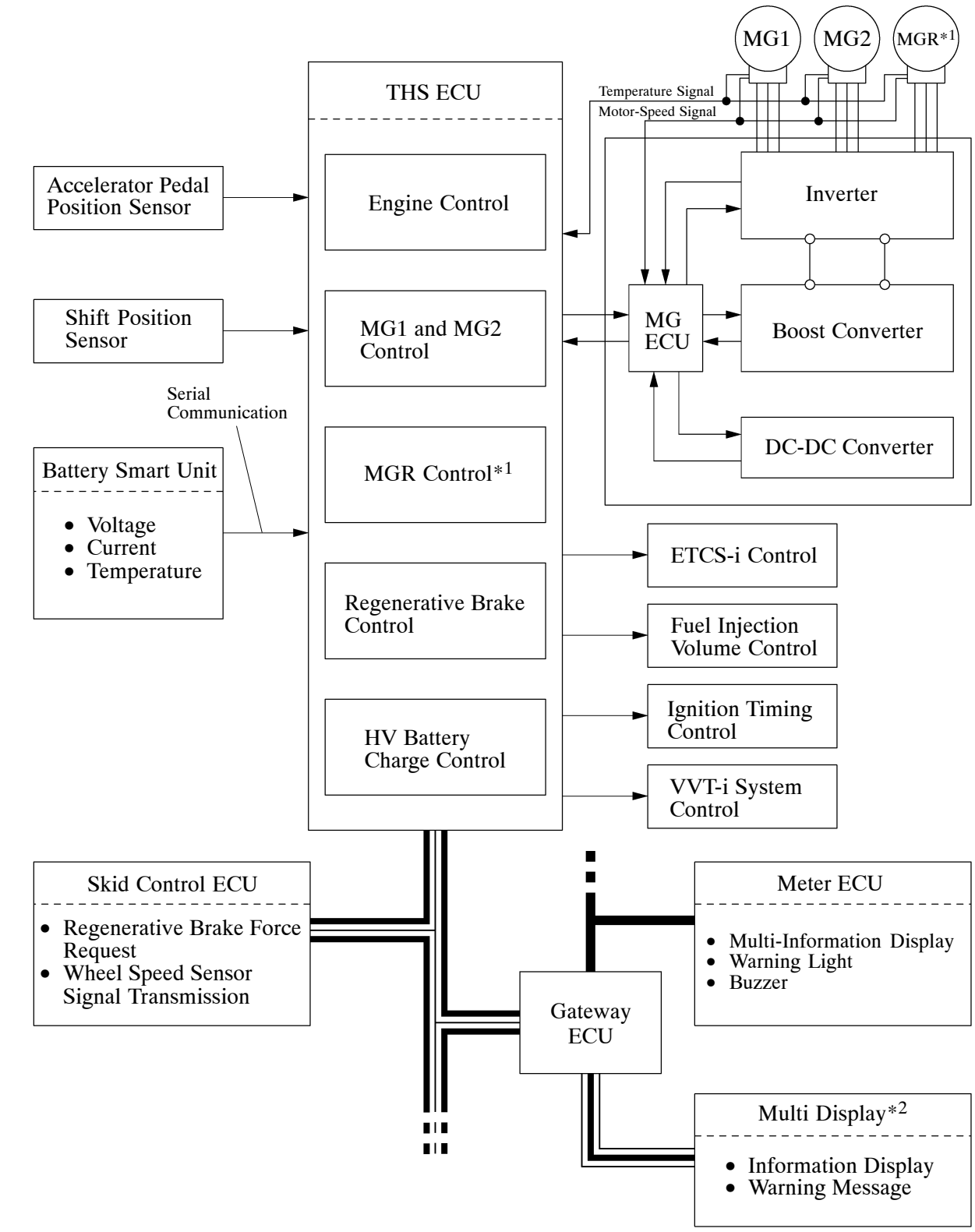
▶ Flow of Motive Force Calculation ◀

(Target Motive Force) - (Engine Motive Force) = (MG2 Motive Force)



277TH65

▶ System Diagram ◀



: CAN

: BEAN

: AVC-LAN

*1: Only on models with 4WD-i system

*2: Optional equipment

282TH24

System Monitoring Control

- The THS ECU constantly monitors the SOC (state of charge) of the HV battery. When the SOC is below the lower level, the THS ECU increases the power output of the engine to operate MG1, which charges the HV battery. When the engine is stopped, MG1 operates to start the engine; then, the engine operates MG1 to charge the HV battery.
- If the SOC is low, or the temperature of the HV battery, MG1, MG2 or MGR* is higher than the specified value, the THS ECU restricts the motive force applied to the drive wheels until it is restored to the normal value.

*: Only on models with 4WD-i System

Shut Down Control

Generally, MG1 and MG2 are shut down when the shift position is in the N position. This is because MG1 and MG2 must be stopped electrically as a means of shutting down the motive force, since MG2 is mechanically joined to the front wheels. On the model with the 4WD-i system, the MGR will also shut down at the same time.
However, the shut down function is canceled under the following exceptions:

- During driving, if the brake pedal is depressed and a wheel lock up, the ABS function is activated. After this, low torque is requested from the MG2 to provide supplemental power in order to restart the rotation of the wheel. Even if the shift position is in the N position at this time, the shut down function is canceled to allow the wheel to rotate. After the wheel rotation has been restarted, the system resumes its shut down function.
- When the vehicle is driven in the D or B position and the brake pedal is depressed, the regenerative brake operates. At this time, as the driver moves the shift position to the N position, the brake hydraulic pressure increases while the request torque of the regenerative brake decreases gradually so as not to create a sluggish brake feel. After this, the system effects the shut down function.
- When MG1 and MG2 operate at higher speed than the specified level, the shut down function is canceled.

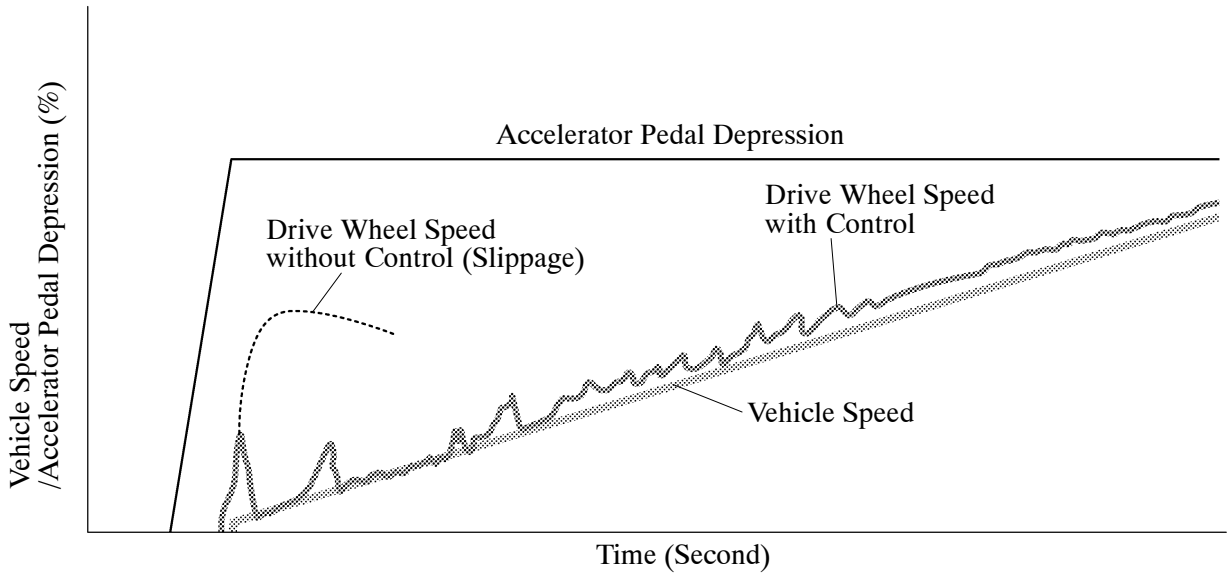
Motor Traction Control

1) General

- If a drive wheels slips while the vehicle is being driven on a slippery road surface, MG2 (which is coupled directly to the wheels) will spin excessively, causing the relative rotational speed of the compound gear unit to increase. This condition could damage the areas that support the parts in the compound gear unit, such as through seizure. In some cases, this condition could cause MG1 to generate an excessive amount of electricity. For this reason, if the THS ECU determines that MG2 is spinning excessively upon monitoring a sudden change in rotational speeds by way of speed sensor signals, the THS ECU applies a brake force to suppress the rotation, in order to protect the compound gear unit.
- Furthermore, if only one of the drive wheels spins excessively, the THS ECU will monitor the speed difference between the right and left wheel by way of the speed sensors of the respective wheels, and the THS ECU will transmit a command to the skid control ECU in order to apply a brake to the wheel that is spinning excessively.

These controls achieve the same effect as the TRAC function of the brake control system.

▶ Image Diagram ◀

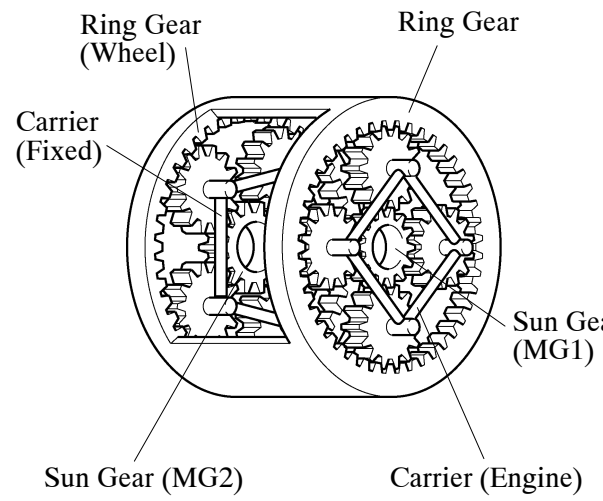


Drive wheel speed behavior at start-up a snowy road

277TH106

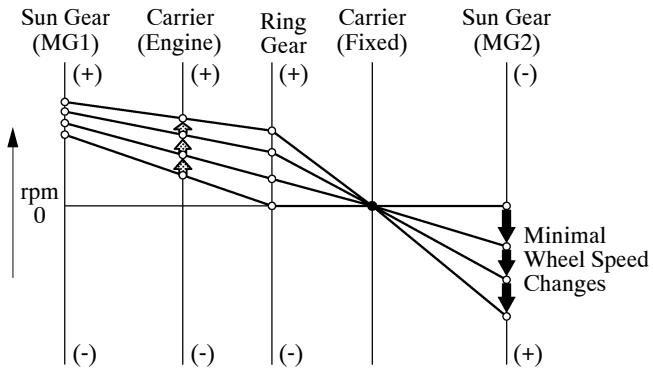
2) Operation

- The following describes the mechanism that generates the excessive rotation. For example, if the drive wheels have a normal grip, the changes in the rotational speed of MG2 (drive wheels) are minimal, as shown in Figure (a). Thus, the proper balance is maintained between them and the engine with minimal changes in speed, resulting in minimal differences in the relative rotational speeds of the compound gear unit as a whole.
- If the drive wheels are in the state of loss of traction, a rotation speed of MG2 (drive wheels) varies largely as shown in Figure (b). As a result, difference of the relative rotation speeds in the whole compound gear unit becomes larger, because the engine that has a small rotating variation cannot follow the rotation of MG2.



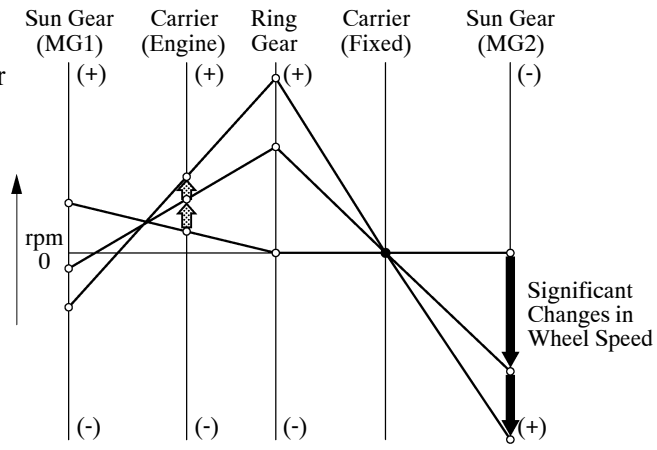
Planetary Gear Unit Schematic Diagram

277TH67



(a) Drive Wheels Gripping

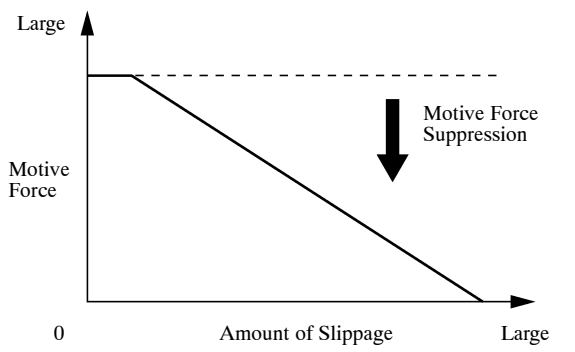
277TH68



(b) Drive Wheels Slipping

277TH69

- The THS ECU monitors sudden changes in speed through the speed sensor signals provided by MG2, in order to calculate the amount of slippage of the drive wheels. The THS ECU controls the motive force by suppressing the rotation of MG2 in accordance with the calculated amount of slippage.



Conceptual Image of Motor Traction Control

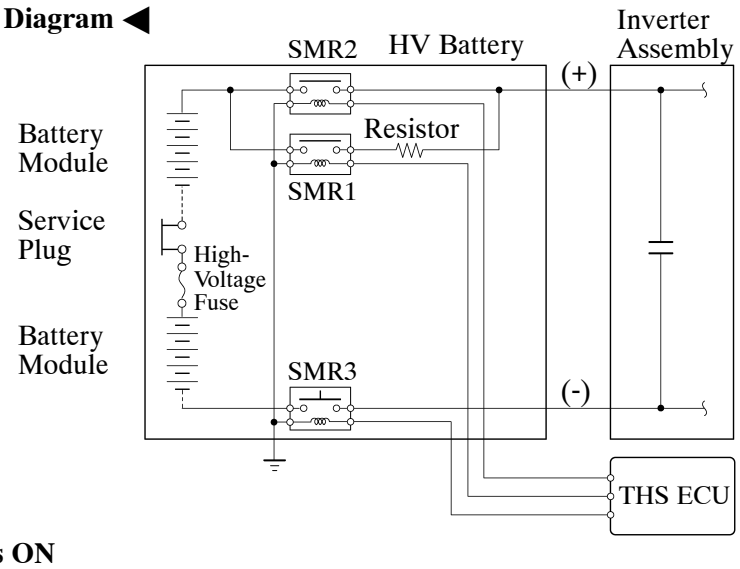
255TH67

SMR (System Main Relay) Control

1) General

The SMR is a relay that connects and disconnects the power source of the high-voltage circuit upon receiving a command from the THS ECU. A total of 3 relays, one for the negative side, and two for the positive side, are provided to ensure proper operations.

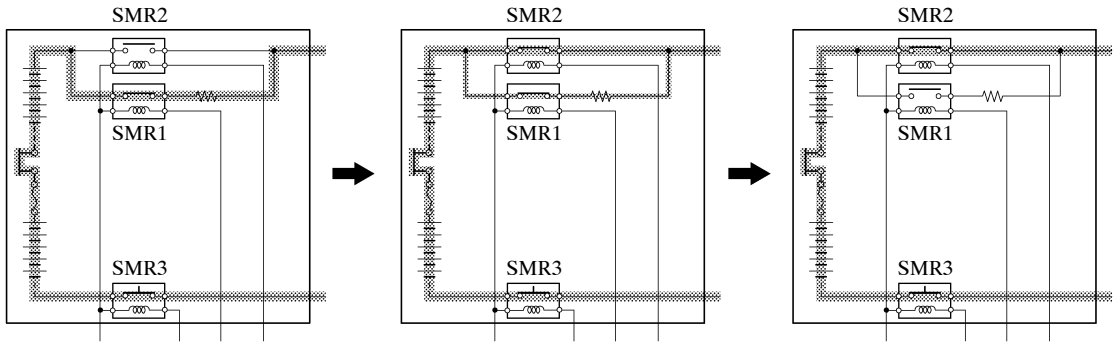
▶ System Diagram ◀



277TH70

2) Power is ON

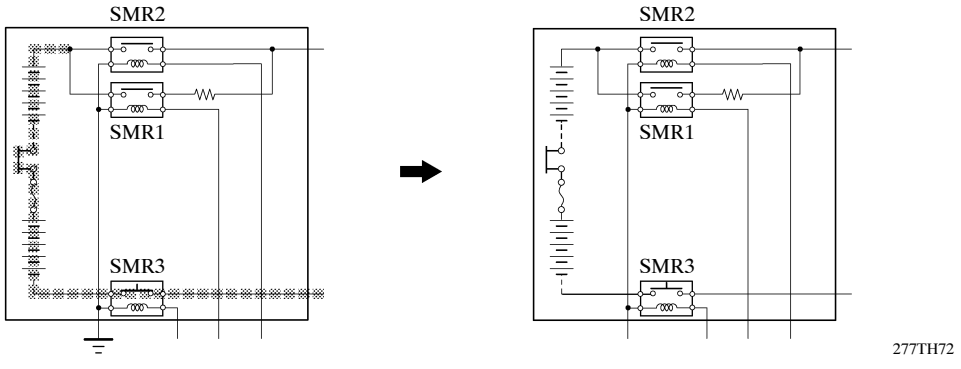
SMR1 and SMR3 turn ON when the circuit is connected; subsequently, SMR2 turns ON and SMR1 turns OFF. As the controlled current is initially allowed to pass through a resistor in this manner, the contact point in the circuit is protected from damage that could be caused by a rush current.



277TH71

3) Power is OFF

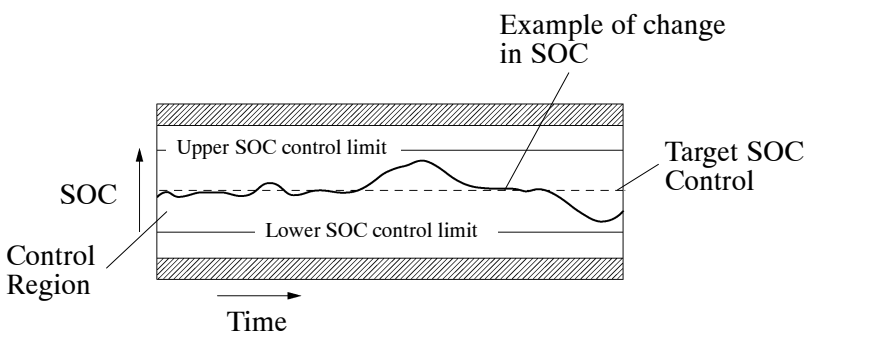
SMR2 and SMR3 turn OFF when the circuit is disconnected, in that order. Then, the THS ECU verifies that the respective relays have been properly turned off. Accordingly, the THS ECU is able to determine if SMR2 is stuck.



277TH72

SOC Control

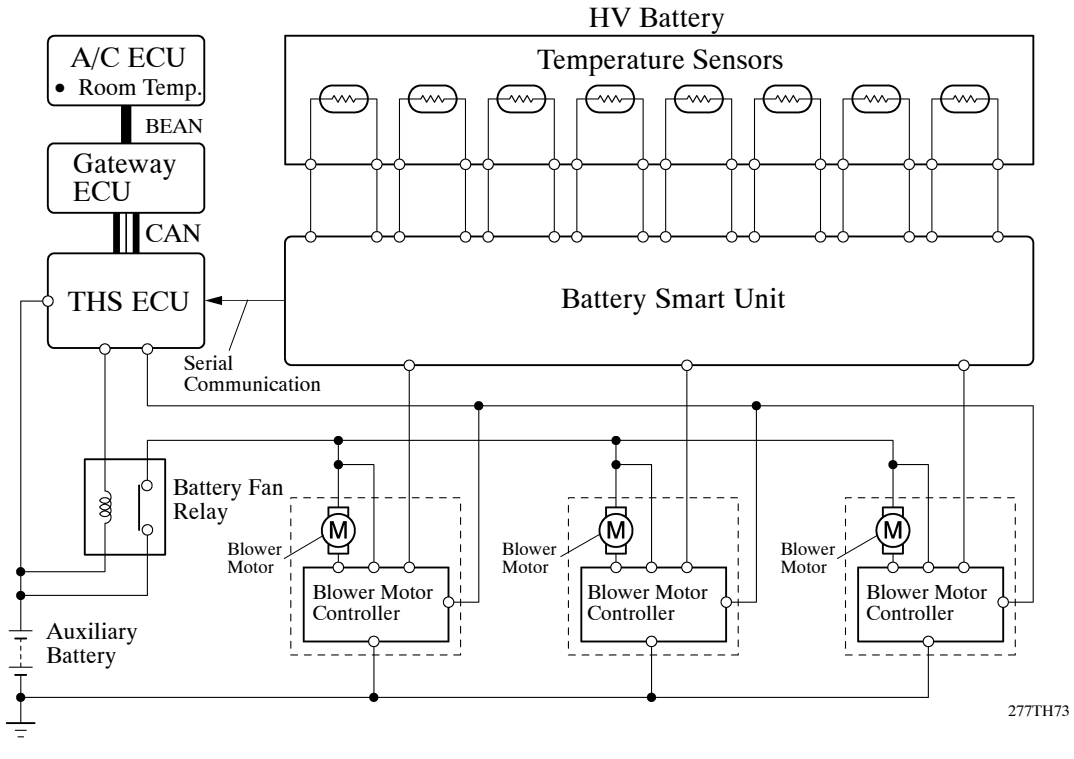
- The THS ECU calculates the SOC (state of charge) of the HV battery by estimating its charging and discharging amperages, in order to effect condition control.
- While the vehicle is in motion, the HV battery undergoes repetitive charging/discharging cycles, as it becomes discharged by the MG2 or MGR (with 4WD-i system) during acceleration and charged by the regenerative brake during deceleration. The THS ECU calculates the SOC based on charging/discharging levels detected by the current sensor. The THS ECU performs the charging/discharging control based on the calculated value in order to steady the SOC at its target level anytime.



Cooling Fan Control

- The THS ECU detects the rise in the battery temperature via the eight temperature sensors in the HV battery. Then, the THS ECU steplessly actuates the cooling fan under duty cycle control, in order to maintain the temperature of the HV battery within the specified range.
- While the air conditioning system is operating and cooling down the cabin, if the HV battery temperature is within a normal range, the THS ECU turns the battery cooling fans OFF or changes the fan speed to LO speed. The purpose of this control is to give priority to cooling down the cabin, which also provides cooling to the battery through the air intake duct located under the rear seat.

▶ System Diagram ◀



4. MG1, MG2 and MGR* Main Control

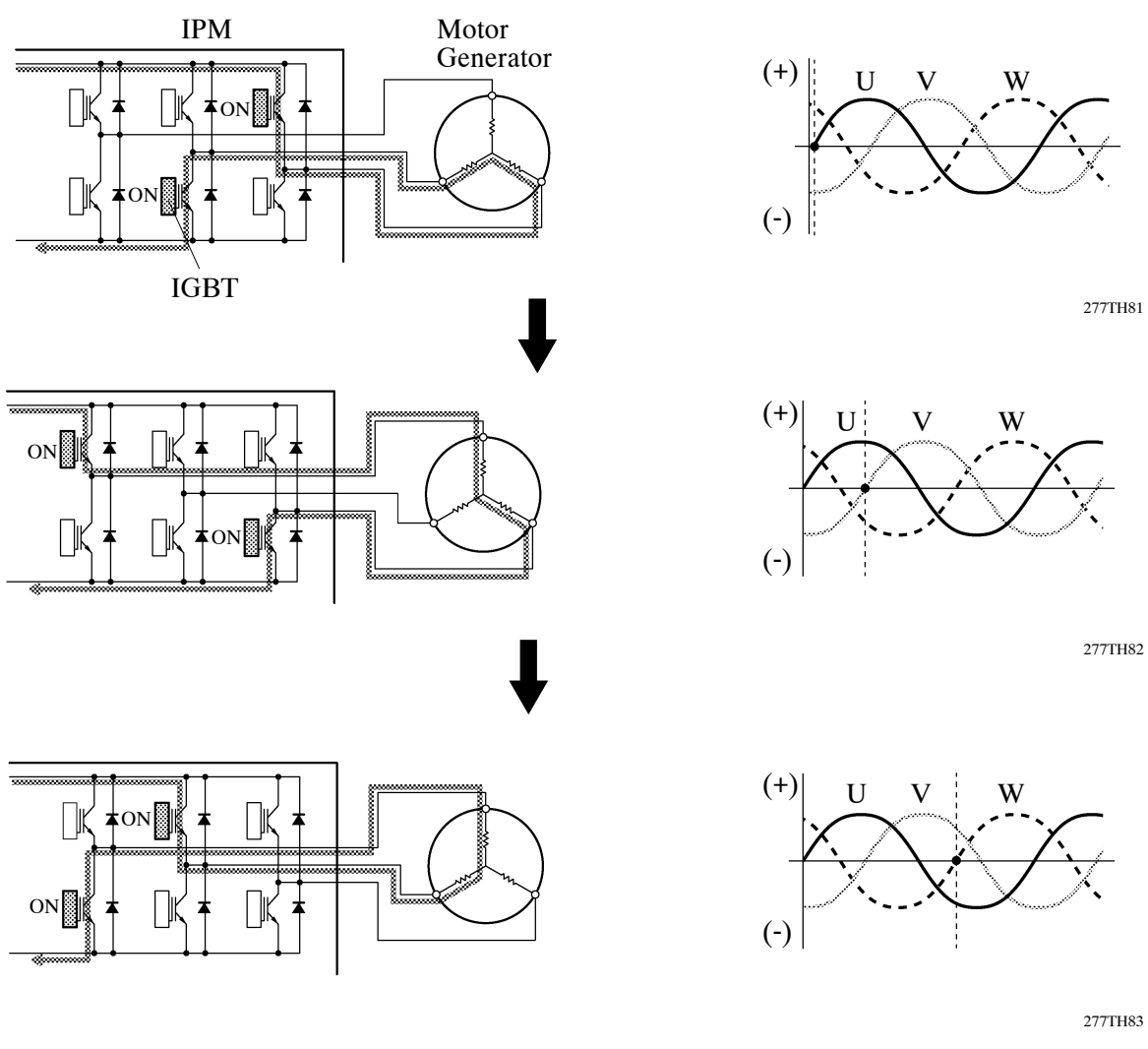
General

- MG1, which is rotated by the engine, generates high voltage (alternating current) in order to operate MG2 and charge the HV battery. Also, it functions as a starter to start the engine.
- MG2 is driven by electrical power from MG1 or HV battery, and generates motive force for the front wheels.
- On the 4WD-i system model, MGR is driven by the electrical power from the HV battery, and generates motive force for the rear wheels.
- MG2 and MGR* generate electricity to charge the HV battery (regenerative brake control) during braking, or when the accelerator pedal is not being depressed.
- The MG ECU, which follows the commands of the THS ECU, controls MG1, MG2, and MGR* via the IPM (Intelligent Power Module), for driving the vehicle. Six IGBTs (Insulated Gate Bipolar Transistors) switch ON and OFF to control the individual motors in accordance with the driving or generation operation.

*: Only on models with 4WD-i system

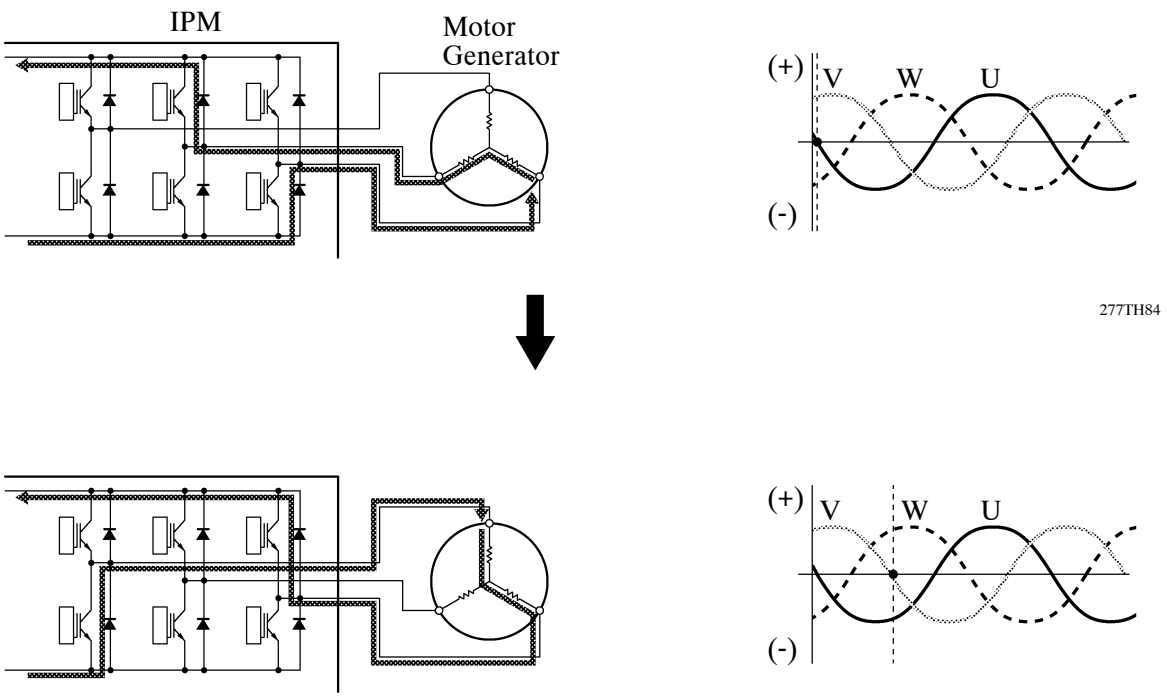
Motor Drive Operation

- The illustration below describes the basic control for driving a motor. The IGBTs (Insulated Gate Bipolar Transistors) in the IPM switch ON and OFF to supply a three-phase alternating current to the motor.
- In order to create the motive force required of the motor generator as calculated by the THS ECU, the MG ECU switches the IGBTs ON and OFF and controls the speed, in order to control the speed of the motor generator.



Motor Generation Operation

The illustration below describes the basic control for the motor to generate electricity. The current that is generated sequentially by the three phases of the motor, which is driven by the wheels, is utilized to charge the HV battery or drive another motor generator.



277TH84

277TH85

277TH86

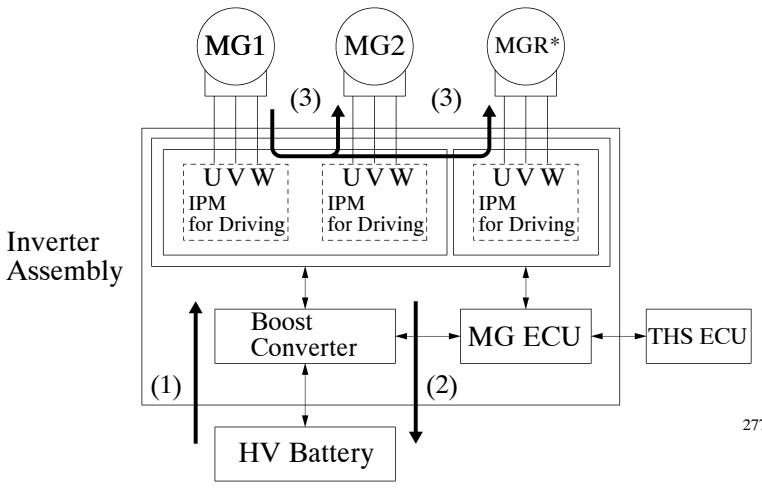
5. Inverter Assembly Control

General

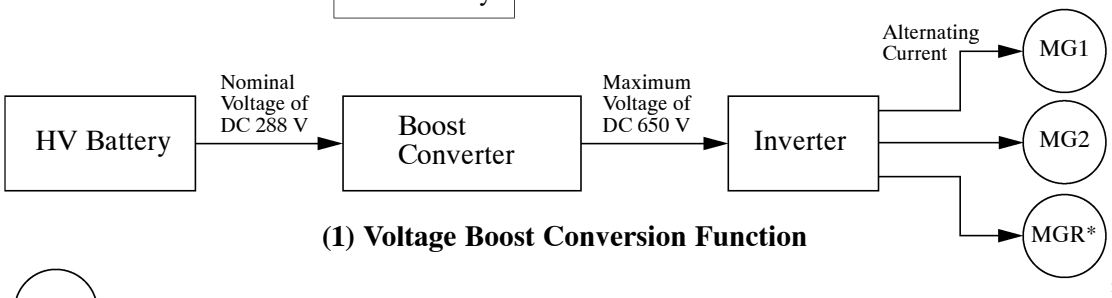
- The inverter converts the direct current from the HV battery into an alternating current for MG1, MG2, and MGR*, or vice versa, in accordance with the signals provided by the THS ECU via the MG ECU. In addition, the inverter supplies the alternating current from the MG1 power to the alternating current for MG2 or MGR*. However, the electricity that is supplied by MG1 to MG2 or MGR* is converted into DC inside the inverter.
- Via the MG ECU, the THS ECU transmits a signal to the power transistor in the inverter for switching the U, V, and W phases of stator coil of MG1, MG2, and MGR* based on the rotor position information sent by MG1, MG2, and MGR*, and the SOC of the HV battery sent by the battery smart unit.
- When the shift lever is in the N position, or the THS ECU has received an over-heating, over-current, or fault voltage signal from the inverter, the THS ECU transmits a shut down control signal to the inverter, in order to disengage the electrical connection to MG1, MG2, and MGR*.

*: Only on models with 4WD-i System

▶ System Diagram ◀

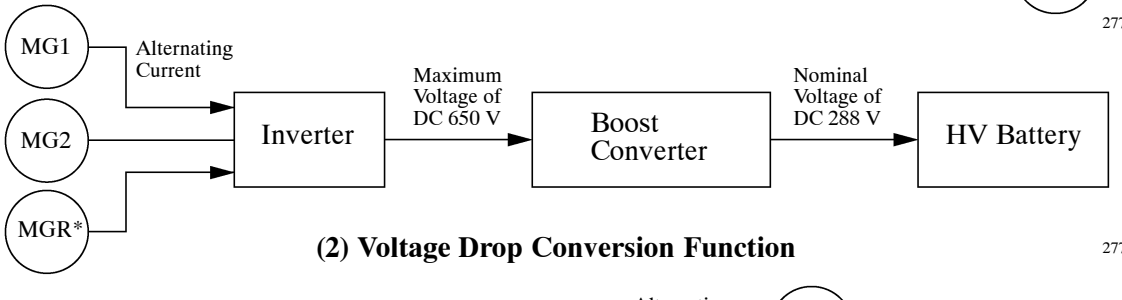


277TH74



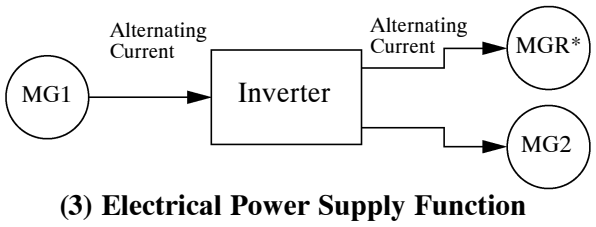
(1) Voltage Boost Conversion Function

277TH75



(2) Voltage Drop Conversion Function

277TH76



(3) Electrical Power Supply Function

277TH95

*: Only on models with 4WD-i System

Boost Converter Control

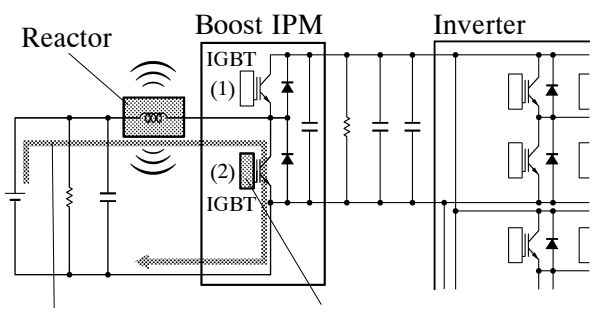
1) General

- The boost converter boosts the nominal voltage of DC 288V (for the HV battery) up to a maximum voltage of DC 650V, in accordance with the signals provided by the THS ECU via the MG ECU.
- The inverter converts the alternating current generated by MG1 or MG2 into a direct current. The boost converter drops the maximum voltage of DC 650V to nominal voltage of DC 288V (for the HV battery) in accordance with the signals provided by the THS ECU via the MG ECU.
- The boost converter consists of a boost IPM (Intelligent Power Module) with built-in IGBTs (Insulated Gate Bipolar Transistors) that effect switching control, and a reactor that stores (and charges) electrical power.

2) Voltage Boost Conversion Function

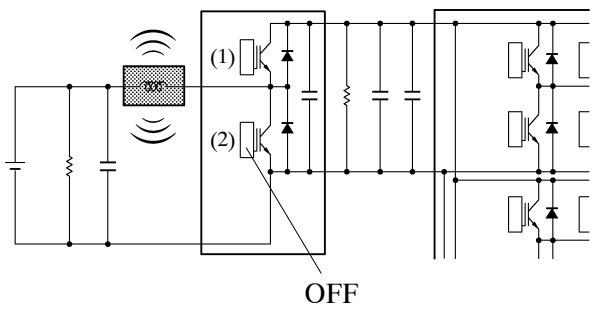
- The function of the boost converter to boost the nominal voltage of the HV battery from DC 288V to maximum voltage of DC 650V flows as described below.

- The IGBT (2) turns ON, causing the electrical power of the HV battery (nominal voltage of DC 288V) to charge the reactor. As a result, the voltage in the reactor rises.



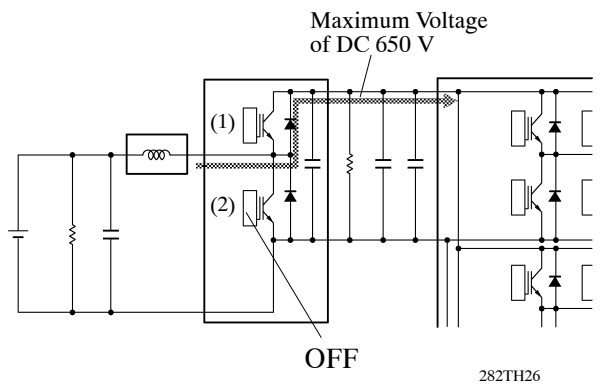
277TH77

- In the next stage, when the voltage in the reactor rises to maximum voltage of DC 650V, the IGBT (2) turns OFF, causing a counter electromotive force to be created.



282TH25

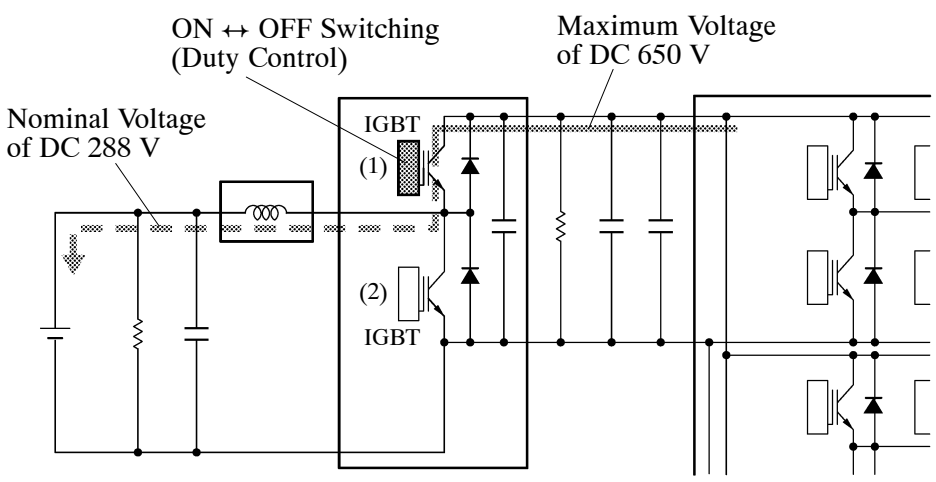
- Induced by the counter electromotive force that is created, the electrical power (maximum voltage of DC 650V) that is charging the reactor flows into the inverter.



282TH26

3) Voltage Drop Conversion Function

The alternating current, which is generated by MG1 or MG2 for the purpose of charging the HV battery, is converted into maximum voltage of DC 650V by the inverter. Then, a function of the boost converter drops the voltage to nominal voltage of DC 288V. This is accomplished by the IGBT (1) switching ON and OFF through duty cycle control, which intermittently interrupts the electrical power provided by the inverter.



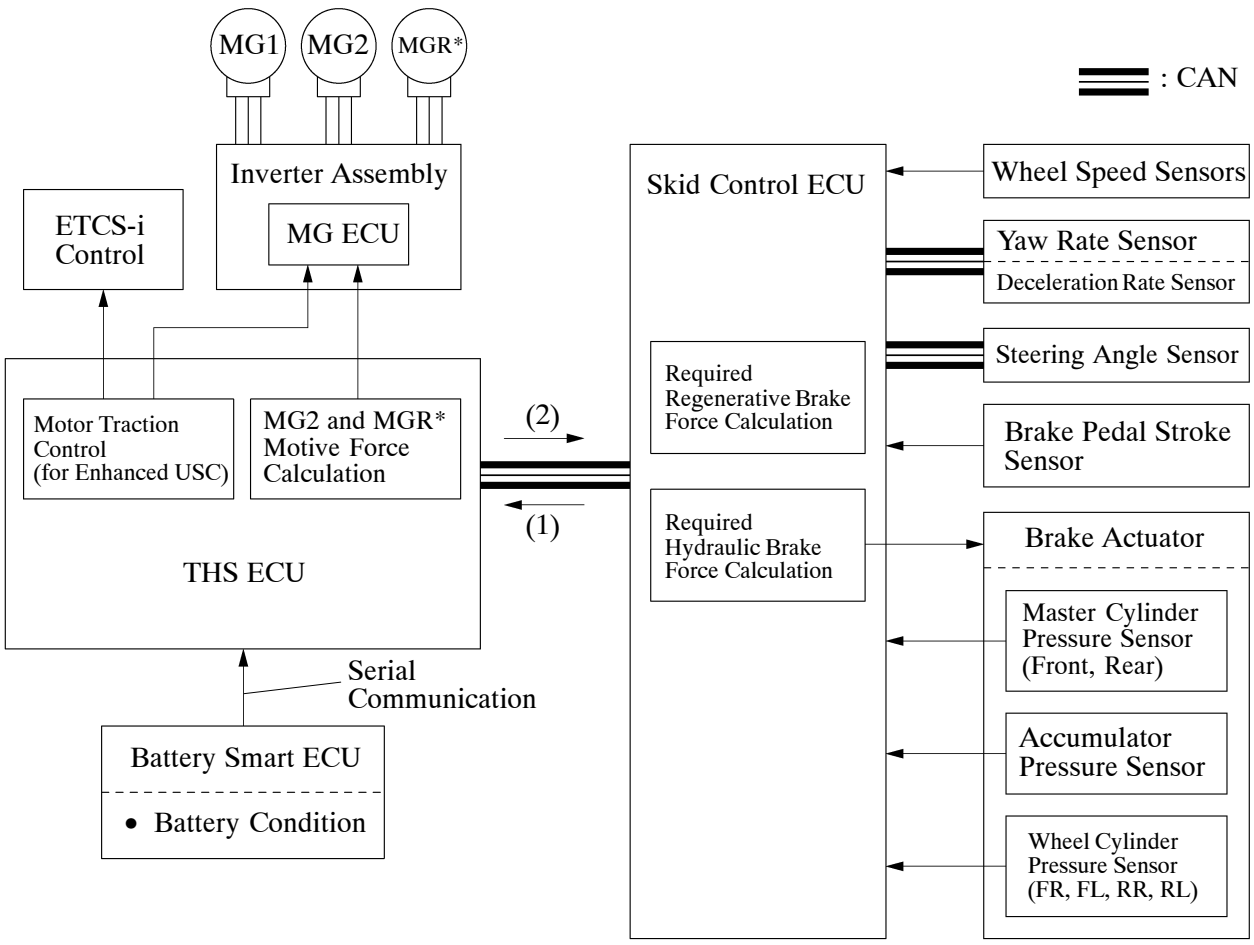
277TH80

6. Skid Control ECU Control

- The skid control ECU calculates the total braking force needed, based on the master cylinder pressure in the brake actuator and brake pedal stroke sensor generated when the driver depresses the brake pedal.
- The skid control ECU computes a part for the required regeneration brake force from the total braking force, and sends the result to the THS ECU.
- The THS ECU executes to the minus torque to MG2 and MGR*, and carries out the regenerative brake functions.
  The skid control ECU controls the brake actuator solenoid valves and generates the wheel cylinder pressure, which is the actual regenerative brake control value subtracted from the total braking force.
- The skid control ECU outputs a request to the THS ECU to effect motor traction control while the vehicle is operating under VSC function control. The THS ECU controls the engine, MG1, and MG2 in accordance with the present driving conditions in order to suppress the motive force.

*: Only on models with 4WD-i system

▶ System Diagram ◀



(1) : • Required regenerative brake force
  • Required motive force (for TRAC or VSC Function)
(2) : • Actual Regenerative Brake Control Value

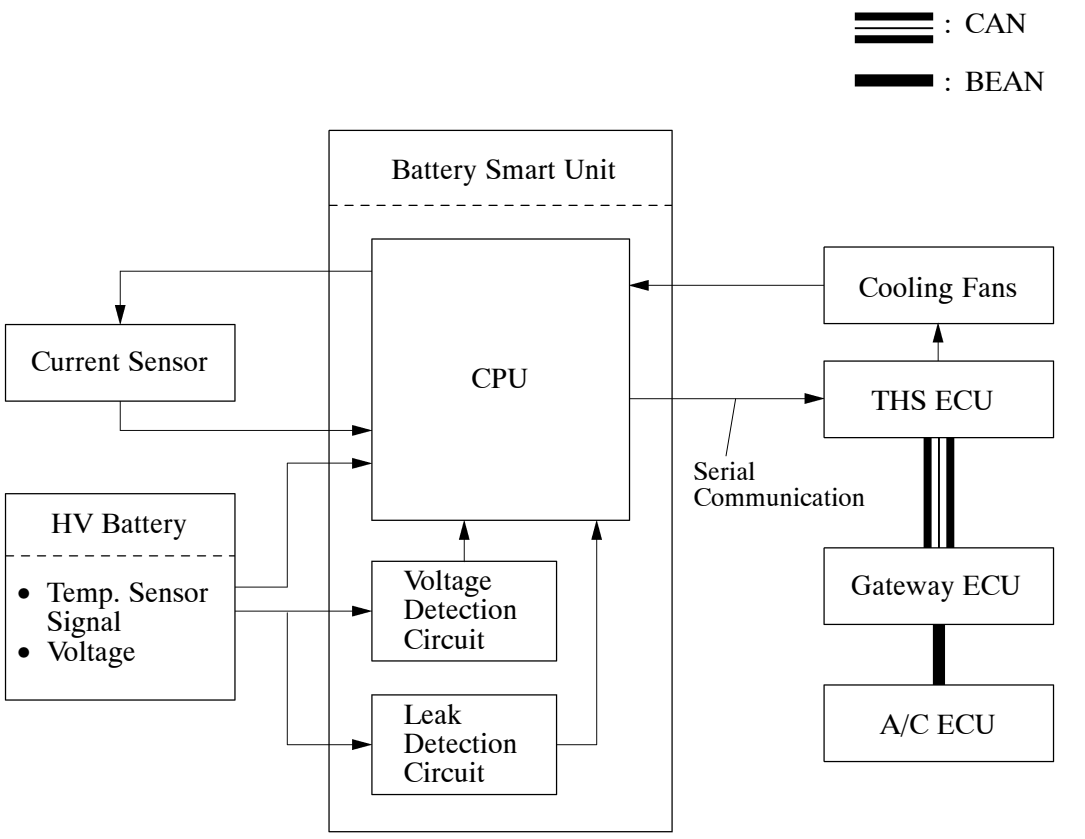
* : Only on models with 4WD-i system

277TH87

7. Battery Smart Unit Control

- The battery smart unit converts the HV battery condition signals (voltages, currents, and temperatures), which are used to determine charging or discharging values, into digital signals, and transmits them to the THS ECU via serial communication.
- Furthermore, the battery smart unit detects the cooling fan voltage signals which are necessary to effect cooling fan control, and converts them into digital signals and transmits them to the THS ECU through serial communication.
- A leak detection circuit is provided in the battery smart unit in order to detect any excessive current draw from the HV battery.

▶ System Diagram ◀



282TH22

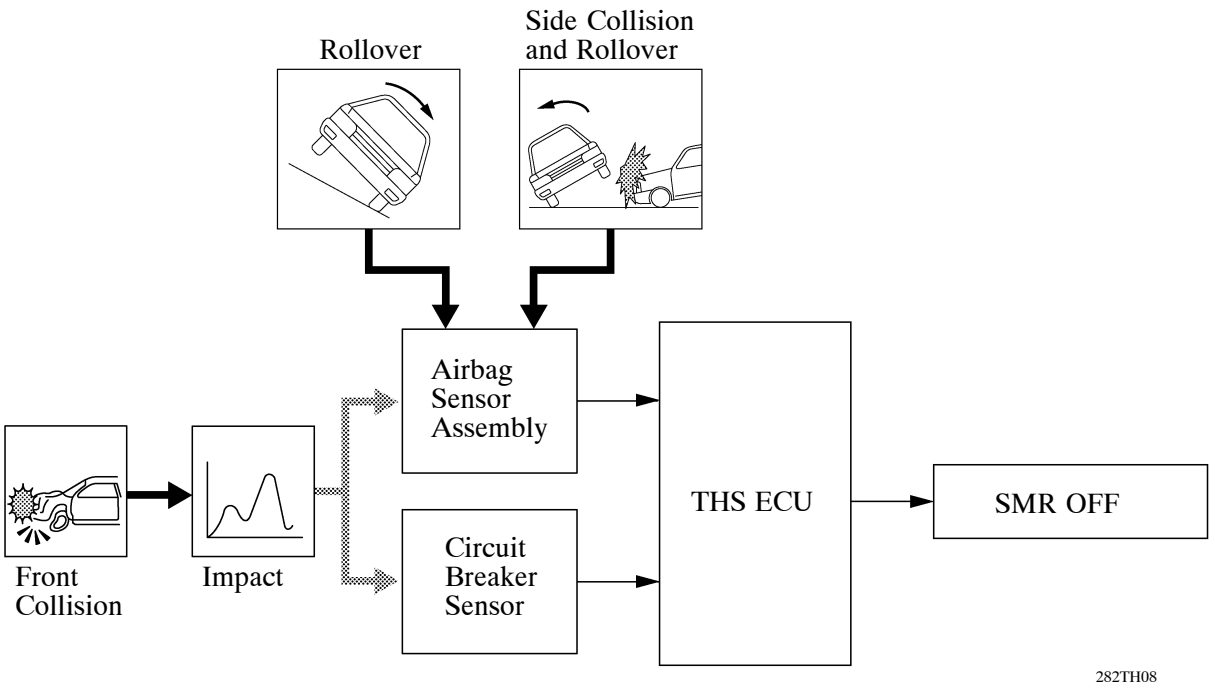
8. During Collision Control

General

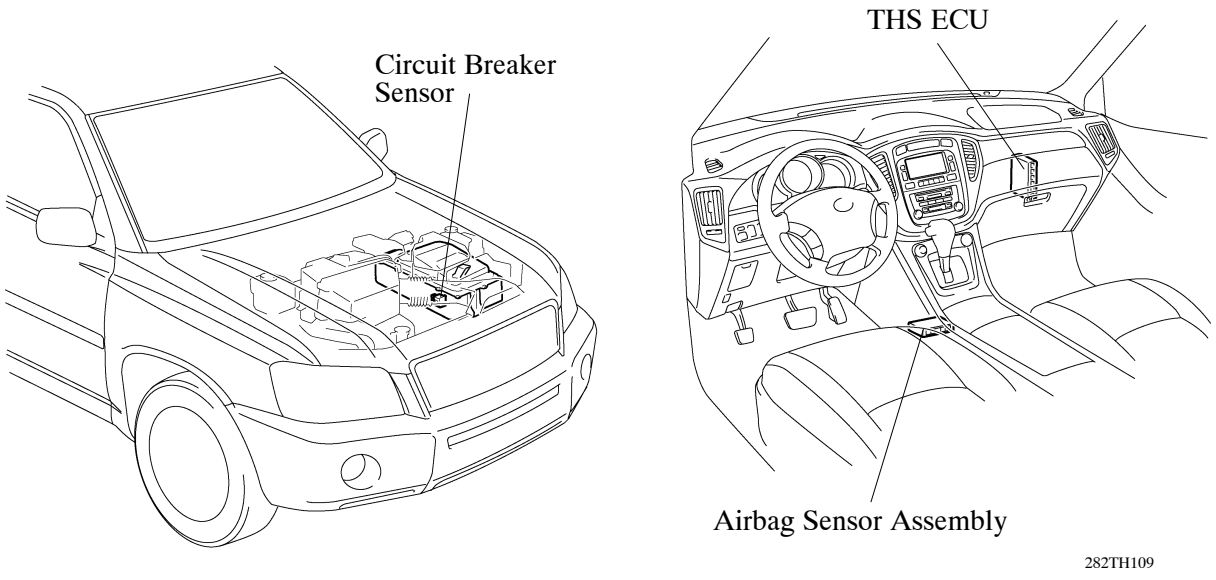
If the vehicle encounters one of the situations described below, the THS ECU will shut down the entire power supply by turning the SMR (System Main Relay) OFF, in order to ensure safety.

- The THS ECU receives an airbag deployment signal from the airbag sensor assembly during a frontal collision, side collision, or rollover.
- The THS ECU receives an actuation signal for the circuit breaker sensor, which is provided in the inverter, during a frontal collision.

▶ System Diagram ◀



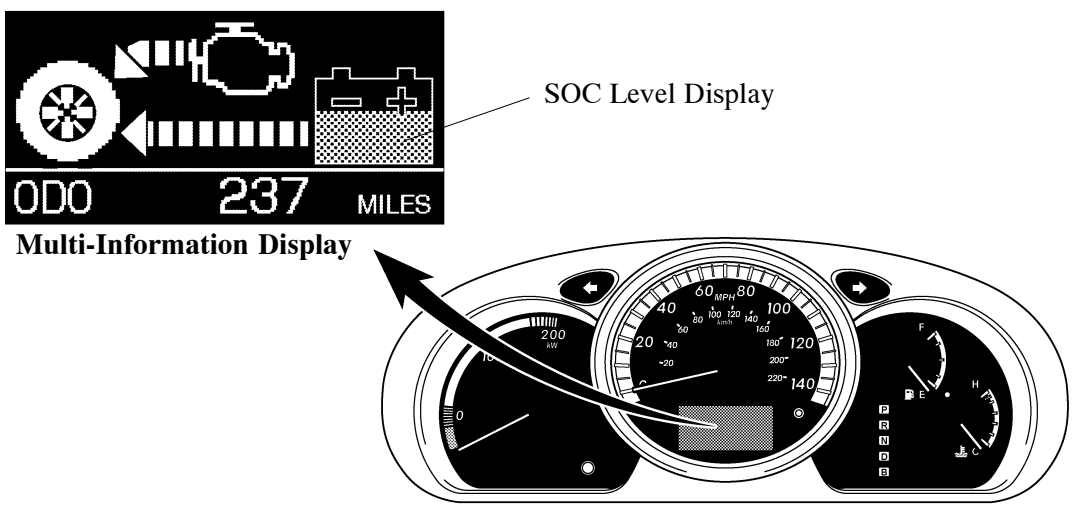
Layout of Main Components



9. Indicator and Warning Light Illumination Control

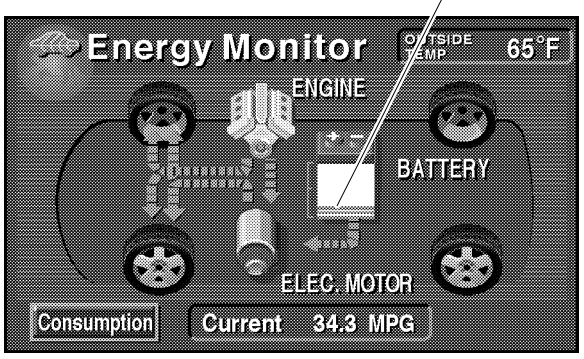
Energy Monitor

- On the ’06 Highlander hybrid model, the multi-information display located on the combination meter has a function to display the energy flow, which enables the driver to monitor the driving conditions of the vehicle. The energy flow, which appears in the form of an arrow, also shows the SOC (state of charge) of the HV battery in 8 levels.



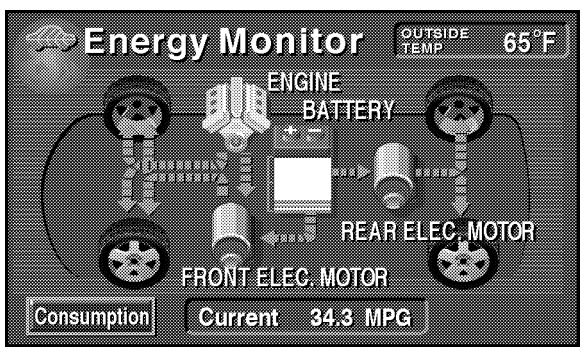
Multi-Information Display

- A multi display, which is available as optional equipment, has a function to display the energy flow with a style that differs from the multi-information display. This display also shows the energy flow in the form of an arrow, and shows the SOC (state of charge) of the HV battery in 8 levels.



2WD Model

282TH19

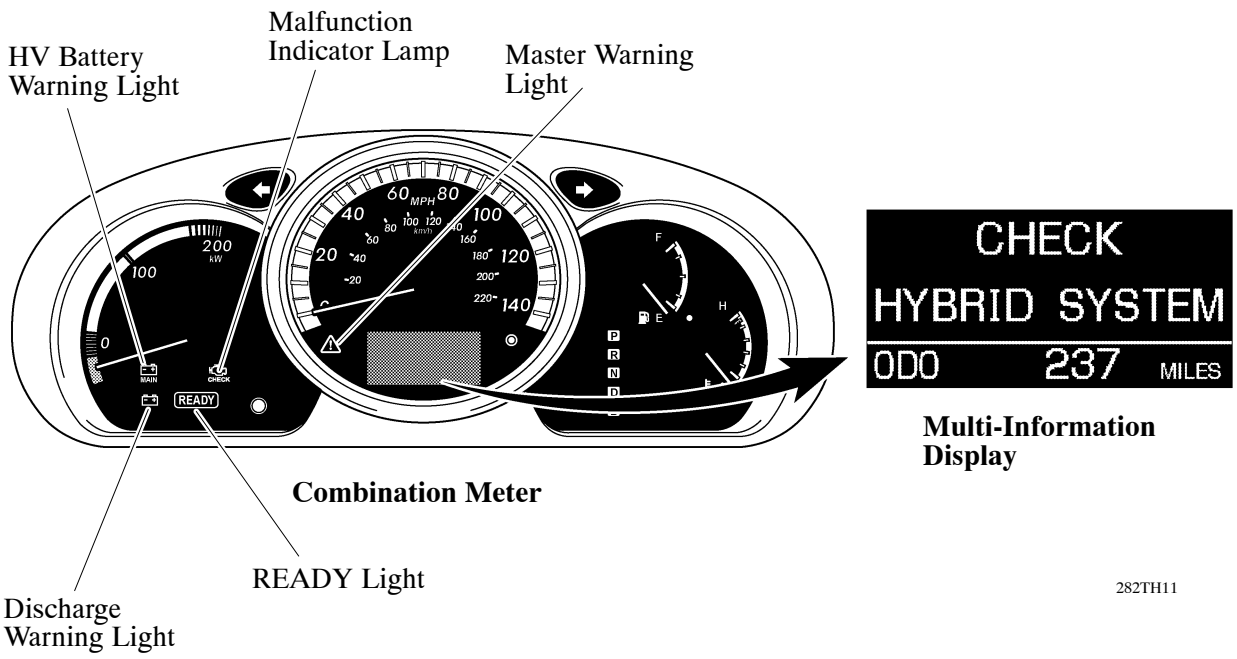


4WD-i Model

282TH20

Indicator and Warning Light

- In particular, the indicator and warning lights associated with the THS-II system are described below.



Combination Meter

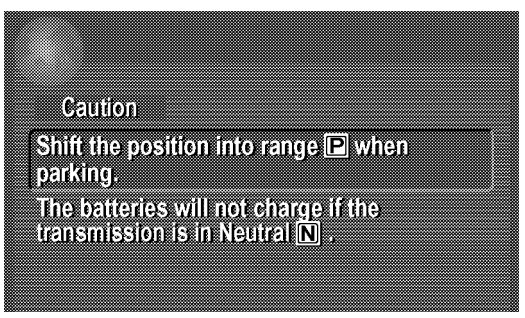
Multi-Information Display

Item	Outline
READY Light	This light blinks when the driver simultaneously presses the brake pedal and turns the ignition switch to the START position while the shift lever is in the P position. Thereafter, the light changes to illumination when the system starts, thus informing the driver that the vehicle is drivable.
Master Warning Light	• The primary function of this warning light, which illuminates simultaneously with the sounding of a warning buzzer, is to inform the driver in case of a malfunction in the THS-II system or when the SOC of the HV battery is lower than the standard. • Besides the foregoing conditions, this light illuminates and the buzzer sounds to inform the driver in case of an abnormal 4WD-i system.
Malfunction Indicator Lamp	Turns on when there is a malfunction in the engine control system.
Discharge Warning Light	Turns on when there is a malfunction in the DC 12 V charging system (converter assembly).
HV Battery Warning Light	This warning light illuminates to inform the driver that the SOC is lower than the minimum standard value (%).
Hybrid System Warning Display	This warning display indicates to inform the driver of a malfunction in the THS-II system. At the same time, the master warning light will illuminate.

- When the condition described below is present, the message prompt as shown appears in the multi-information display and multi display (only on models with multi display), accompanied by the illumination of the master warning light and the continuous sounding of the buzzer.
  - ◆ The READY light is illuminated, the shift position is in the N position, and the HV battery is discharged.

Multi-Information Display

277TH96



Multi Display

282TH21

10. Diagnosis

- In the THS-II system, if the THS ECU detects a malfunction, the ECU performs a diagnosis and memorizes failed sections. Furthermore, to inform the driver of the malfunction, the ECU illuminates or blinks the MIL (Malfunction Indicator Lamp), master warning light, or HV battery warning light, which pertains to the ECU.
- The THS ECU will restore the respective DTCs of the malfunctions.
- Three-digit information codes have been provided in the conventional DTC as subset of a primary five-digit code. This enables the troubleshooting procedure to further narrow down a trouble area to identify a problem.
- The DTCs can be accessed through the use of the hand-held tester with CAN VIM (Dedicated adapter).
- All the DTCs have been made to correspond to the SAE controlled codes. Some of the DTCs have been further divided into smaller detection areas than in the past, and new DTCs have been assigned to them. Additionally, DTCs have been added to correspond to items of this system.

For details, refer to the 2006 Highlander Repair Manual (Pub. No. RM1145U).

11. Fail-Safe

If the THS ECU detects a malfunction in the THS-II system, it will control the system in accordance with the data that is stored in its memory.
For details, refer to the 2006 Highlander Repair Manual (Pub. No. RM1145U).

PE11-005

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4/29/2011

ATTACHMENT 11-2

CONFIDENTIAL BUSINESS INFORMATION

Attachment-Response 11-2

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ATTACHMENT 13-1 THROUGH 13-5

CONFIDENTIAL BUSINESS INFORMATION

Attachment-Response 13-1

Through

Attachment-Response 13-5

Entire Documents Confidential

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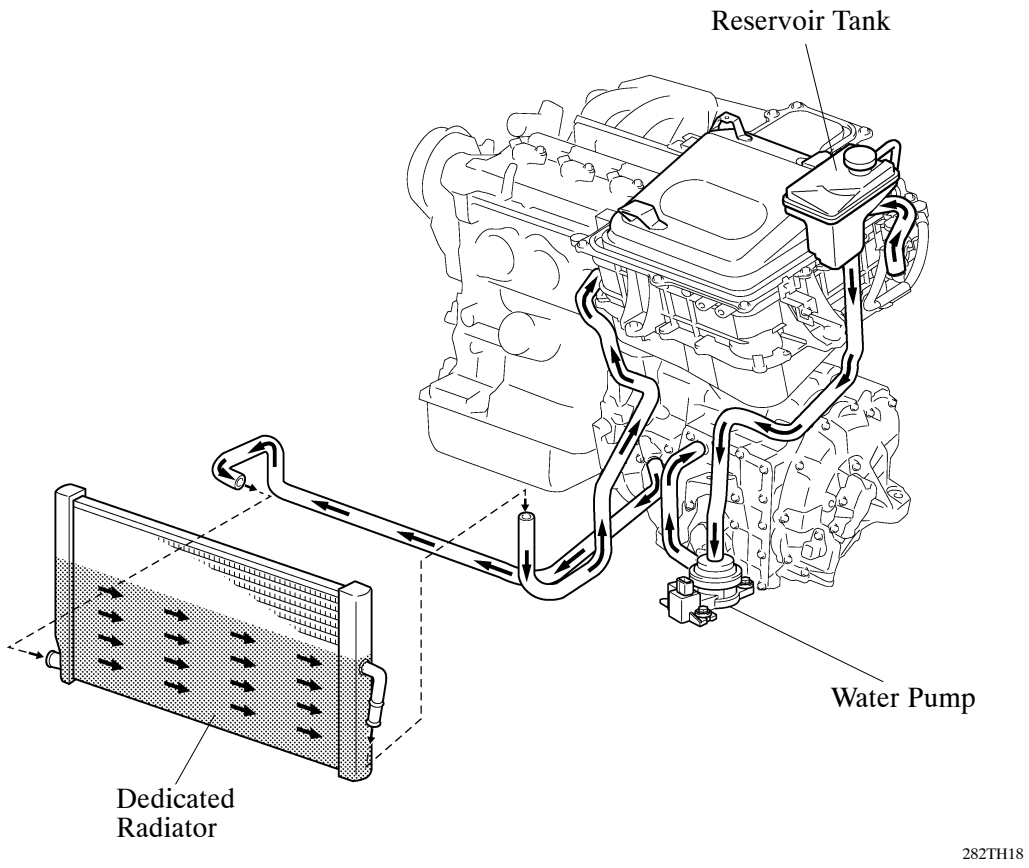
ATTACHMENT 14-1

3. Cooling System (for Inverter, MG1 and MG2)

- A cooling system that is independent from the engine cooling system has been provided for cooling the inverter, MG1, and MG2.
- This cooling system activates when the power supply status is switched to READY ON state.
- The radiator for the cooling system is integrated with the radiator for the engine. Accordingly, the radiator has been simplified and the space it occupies has been optimized.



▶ Specifications ◀

Water Pump	Discharge Volume liter/min.		12 or above (65°C (149°F))
Coolant	Capacity liters (US qts, Imp. qts)		3.4 (3.6, 3.0)
	Type		TOYOTA Genuine Super Long Life Coolant (SLLC) or Equivalent
	Color		Pink
	Maintenance Intervals	First Time	100,000 mile (160,000 km)
		Subsequent	Every 50,000 mile (80,000 km)

- SLLC is pre-mixed (50% coolant and 50% deionized water), so no dilution is needed when adding or replacing SLLC in the vehicle.

PE11-005

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4/29/2011

ATTACHMENT 14-2

Water Pump Specification

[Working condition of Water pump]

・READY ON activates the water pump and READY OFF deactivates it.

[Flow of Cooling fluid (LLC)]

・When the water pump is activated, LLC will cool the front motor, LLC will be cooled by the HV radiator, and then LLC will cool the inverter ASSY and will be circulated back to the reserve tank.

PE11-005

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4/29/2011

ATTACHMENT 15-1 & 15-2

CONFIDENTIAL BUSINESS INFORMATION

Attachment-Response 15-1

and

Attachment-Response 15-2

Entire Documents Confidential

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4/29/2011

ATTACHMENT 16-1

THS-II (TOYOTA HYBRID SYSTEM-II)

■DESCRIPTION

- The ’04 Prius operates under THS-II (Toyota Hybrid System-II), which has carried over the basic components of the THS (Toyota Hybrid System) from the ’03 Prius. To further enhance efficient performance, the controls for the engine, MG1 (Motor Generator No.1), MG2 (Motor Generator No.2), and the battery have been optimized.
- On this model, the capacity of the HV battery has been set to the nominal voltage of DC 201.6 V, the number of the cells has been reduced, and furthermore, boosting the voltage up to the maximum of DC 500 V inside the inverter has been achieved. The boosted direct current is converted into an alternating current inside the inverter in order to drive MG1 and MG2. As a result, a downsized, lightweight and high-power system has been realized.
- The table below describes the newly adopted items.

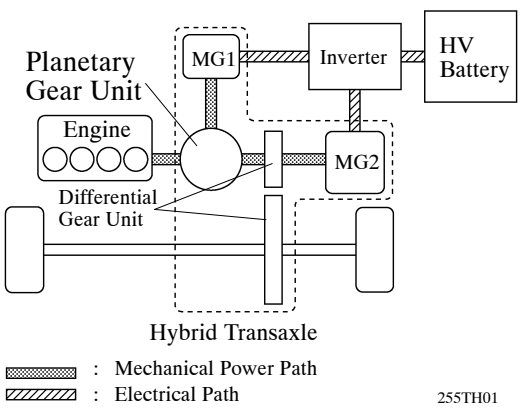
▶ Major Differences ◀

Item	Outline
HV Battery	• The HV battery of the ’03 Prius consists of 228 cells ({1.2V x 6 cells} x 38 modules) with a nominal voltage of DC 273.6 V. In contrast, the HV battery of the ’04 Prius consists of 168 cells ({1.2V x 6 cells} x 28 modules) with a nominal voltage of DC 201.6 V. A compact and lightweight battery configuration has been achieved through these internal improvements. • On the ’03 Prius, the connection between the cells of the HV battery consists of one spot. In contrast, the cells on the ’04 Prius are connected with two spots. The internal resistance of the battery has been reduced by this improvement.
Inverter Assembly	• A boost converter has been included in the inverter. This boosts the nominal voltage of DC 201.6 V that is output by the HV battery to maximum voltage of DC 500 V. • The bridge circuits for MG1, MG2, and the signal processor/protective function processor have been integrated and made compact into an IPM (Integrated Power Module) for driving purposes. • An A/C inverter, which supplies power for driving the electric inverter compressor of the A/C system, has been included in the inverter assembly. • A radiator that integrates an inverter radiator and engine radiator has been adopted to optimize the space it occupies.
MG1	Accompanied by enhancing the rotor robustness of MG1, its rpm range for the maximum possible output has been increased from 6,500 to 10,000 rpm, therefore the charging capability has been enhanced.
MG2	• Structure of each built-in permanent magnet inside the rotor of MG2 has been optimized by redesigning it to V shaped structure, and improvement of its power output and torque has been realized. • For MG2 control, a newly developed over-modulation control system has been adopted to the medium-speed range.
HV ECU	• The HV ECU has been made to efficiently control the systems and functions that have been newly adopted on the ’04 Prius. • The HV ECU has been changed from 16-bit CPU to 32-bit CPU to increase the speed for processing the signals.
ECM	The ECM has been changed from 16-bit CPU to 32-bit CPU to increase the speed for processing the signals.
Battery ECU	• The battery ECU has been made more compact through optimized construction. • The battery ECU has been changed from 16-bit CPU to 32-bit CPU to increase the speed for processing the signals.
Skid Control ECU	The skid control ECU has been changed from 16-bit CPU to 32-bit CPU to increase the speed for processing the signals.
Communication	CAN (Controller Area Network) communication has been adopted to establish communication among the principal ECUs (HV ECU, battery ECU, ECM, and skid control ECU) that are associated with THS-II control.

■FEATURES OF THS-II

1. General

- The hybrid system is a type of power-train that uses a combination of two types of motive forces, such as an engine and a MG2. This system is characterized by its skillful use of two types of motive forces according to the driving conditions. It maximizes the strengths of each of the motive forces and complements their weaknesses. Thus, it can achieve a highly responsive, dynamic performance, as well as a dramatic reduction in fuel consumption and exhaust gas emissions. The THS-II can be broadly divided into two systems: the series hybrid system, and the parallel hybrid system.



255TH01

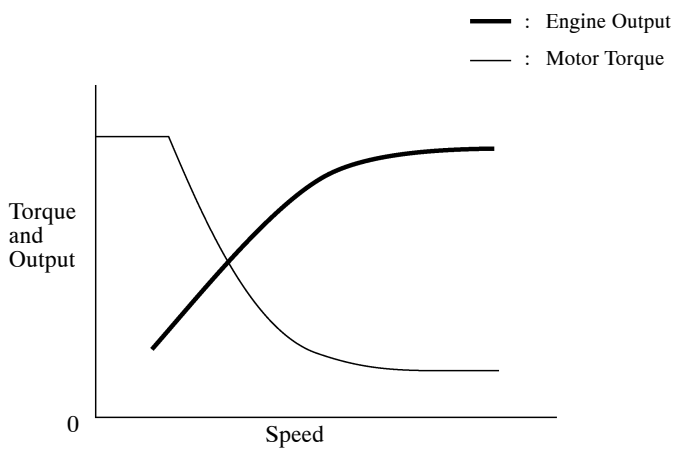


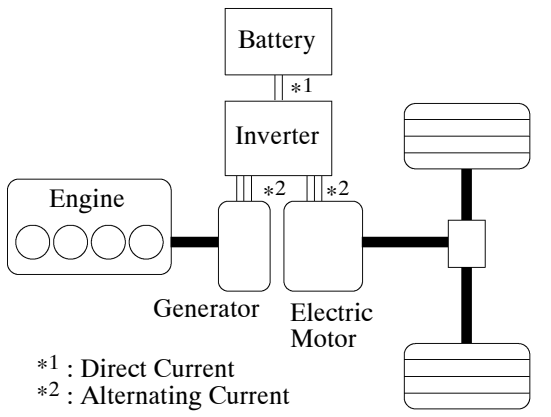
Diagram of the Conceptual Image of the System Performance Curve

255TH02

— REFERENCE —

Series Hybrid System

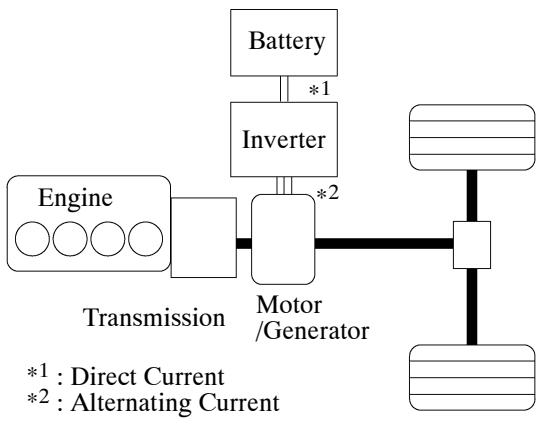
In the series hybrid system, the engine runs a generator, and the generated electricity enables the electric motor to drive the wheels. This type of vehicle can be described as an electric car that is equipped with an engine-driven generator.
Equipped with a low-output engine, the engine is operated at a practically constant speed in its most effective range, in order to efficiently recharge the battery while the vehicle is in motion.



182TH01

Parallel Hybrid System

This system uses both the engine and the electric motor to directly drive the wheels is called the parallel hybrid system. In addition to supplementing the motive force of the engine, the electric motor in this system can also serve as a generator to recharge the battery while the vehicle is in motion.



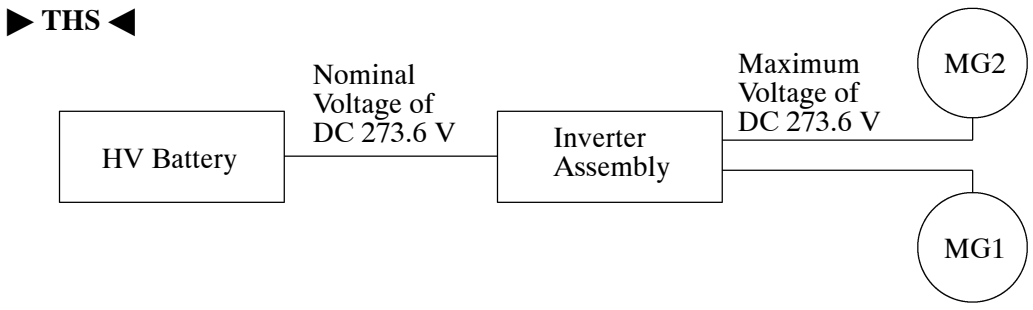
182TH02

2. High-voltage Power Supply System

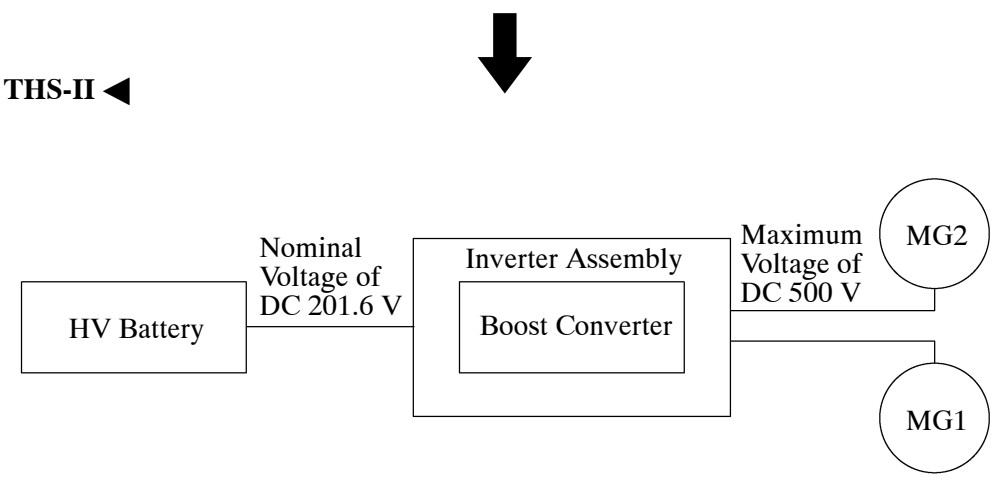
General

In the THS-II of the ’04 Prius, a boost converter has been newly adopted inside the inverter assembly. The boost converter enables the THS-II to provide the power source voltage of 500V at a maximum to MG1 and MG2 (the maximum of the THS on the ’03 Prius is 273.6V), thus electric power is supplied with lower current and high efficiency is realized.

▶ THS ◀



▶ THS-II ◀



255TH94

Power Calculation

Power (P) = Voltage (V) × Current (I)

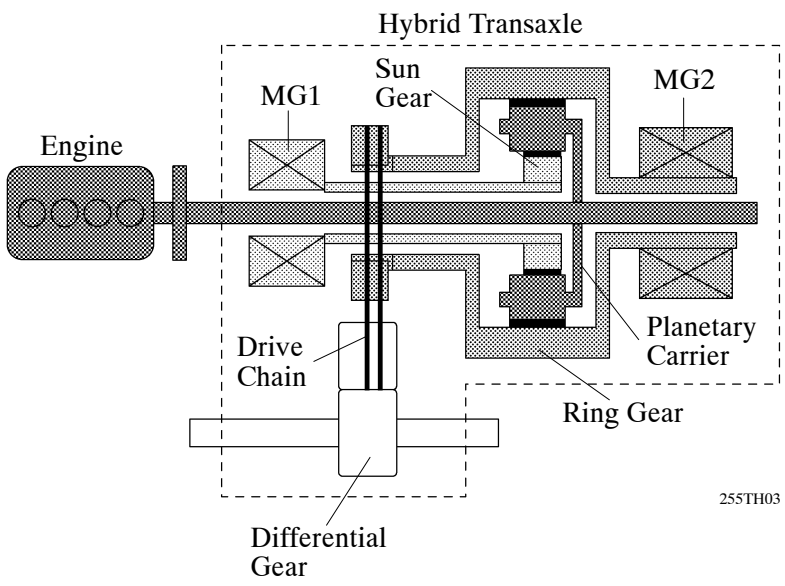
- Power, which expresses the work performed by electricity within a give amount of time, is calculated by multiplying voltage by current. If the power necessary for driving the motor is held constant, the above formula indicates that doubling the voltage reduce the current by 1/2.
- Next, by following Joule’s Law (Calorie = Current^2 × Resistance), the power loss in terms of calories is reduced to 1/4 (1/2 Current × 1/2 Current) if the resistance is held constant. The high-voltage power circuit (boost converter) in THS-II increases power by increasing the voltage while keeping the current constant. Furthermore, for the same power level, increasing the voltage and reducing the current reduces energy loss, resulting in high efficiency.

3. Hybrid Transaxle

General

- While this system efficiently combines and operates the two types of motive forces, the engine and MG2, in accordance with the driving conditions of the vehicle, the basic motive force is provided by the engine. The motive force of the engine is divided into two areas: the motive force applied to the wheels by the planetary gear unit in the hybrid transaxle, and the motive force to operate MG1 as a generator.
- The hybrid transaxle, which contains MG1, MG2, and a planetary gear unit, uses these units to achieve a smooth drive realized through stepless shifting.
- The engine, MG1, and MG2 are mechanically joined via the planetary gear unit.
- MG2 and the differential gear (for the drive wheels) are joined via a drive chain and gears.

For details, refer to P112 Hybrid Transaxle on page CH-2.



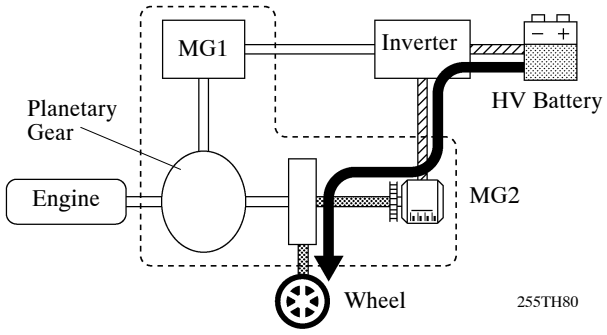
Clutch-Less System

A clutch-less system has been adopted to mechanically link the front wheels and MG2 via gears and a chain. To disengage the motive force in the neutral position, the shift position sensor outputs an N position signal to turn OFF all the power transistors in the inverter (which connects MG1 and MG2). As a result, the operation of MG1 and MG2 shuts down, thus rendering the motive force at the wheels to zero. In this state, even if MG1 is rotated by the engine or MG2 is rotated by the drive wheels, no generation of electricity occurs because both MG1 and MG2 are inactive. As a result, the SOC (state of charge) of the HV battery decreases as the shift position remains in the “N” position.

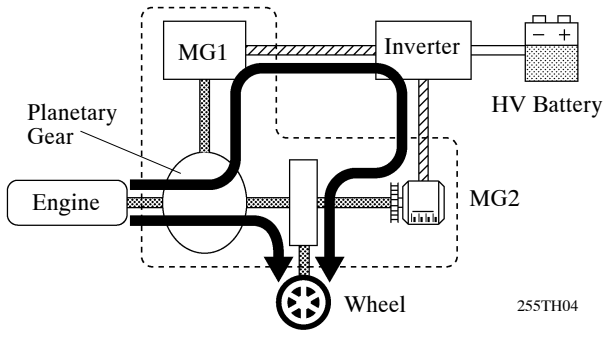
4. Basic Operation

- This system controls the following modes in order to achieve the most efficient operations to match the driving conditions:

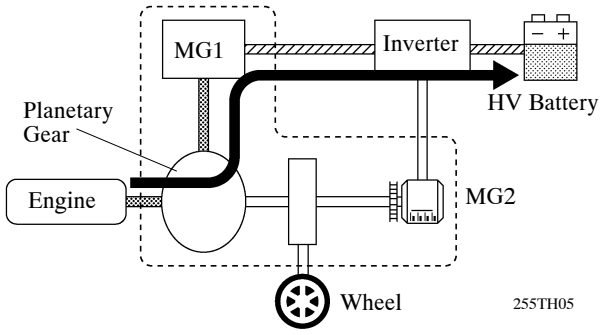
(1) Supply of electrical power from the HV battery to MG2 provides force to drive the wheels.



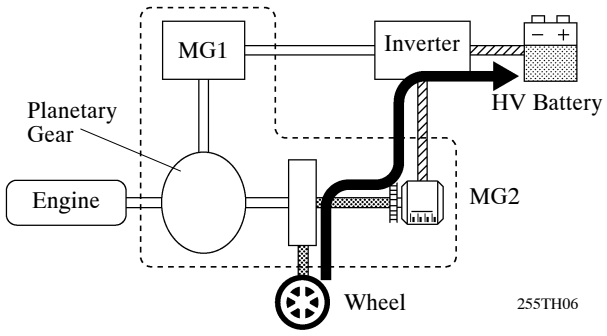
(2) While the wheels are being driven by the engine via the planetary gears, MG1 is rotated by the engine via the planetary gears, in order to supply the generated electricity to MG2.



(3) MG1 is rotated by the engine via the planetary gears, in order to charge the HV battery.



(4) When the vehicle is decelerating, kinetic energy from the wheels is recovered and converted into electrical energy and used to recharge the HV battery by means of MG2.



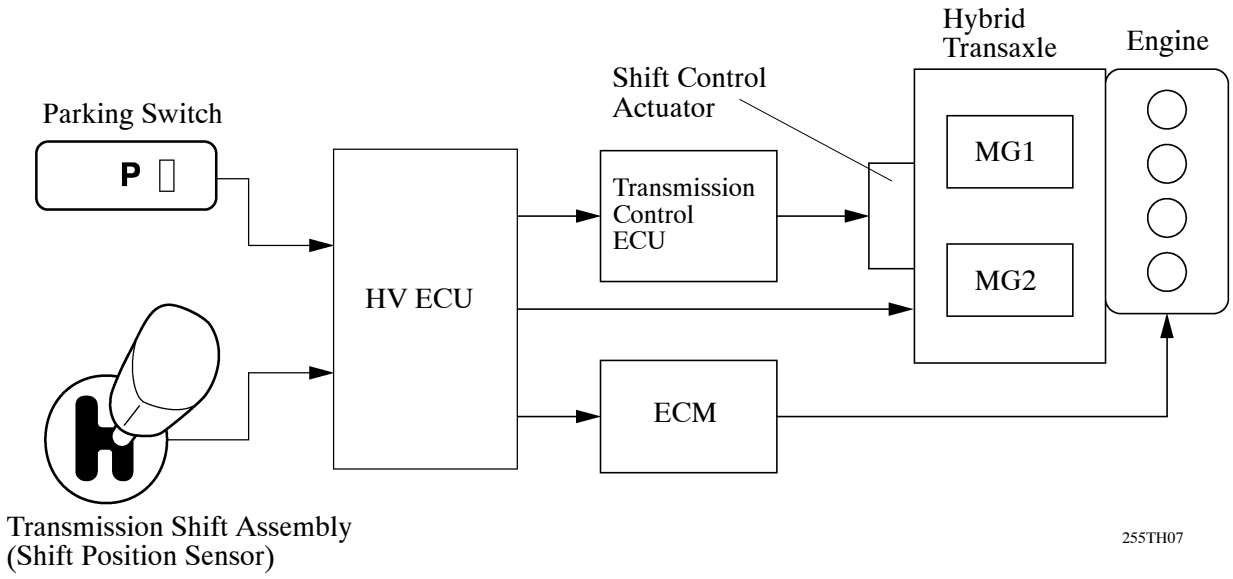
- The HV ECU switches between these modes ((1), (2), (3), (1)+(2)+(3), or (4)) according to the driving conditions. However, when the SOC (State of Charge) of the HV battery is low, the HV battery is charged by the engine by turning MG1.
  As a result, it achieves far greater fuel economy compared to conventional gasoline engine vehicles, at a reduced level of exhaust gas emissions. Furthermore, this revolutionary power-train has eliminated the constraints that are associated with electric vehicles (such as their short cruising range or their reliance on external recharging units).

5. Regenerative Brake

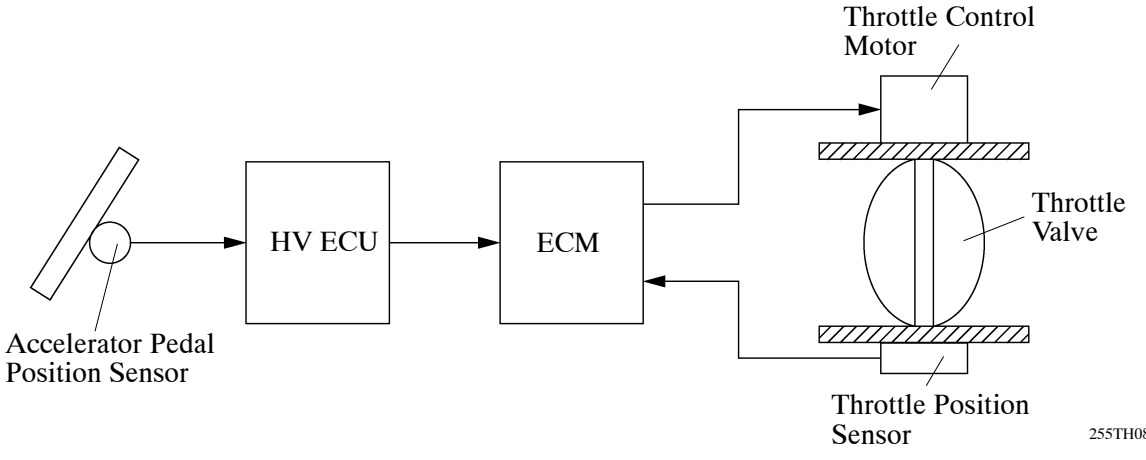
The regenerative brake function operates MG2 as a generator while the vehicle is decelerating or braking and stores this electrical energy in the HV battery. At the same time, it utilizes the operating resistance, which MG2 exerts during the generation of electricity, as a braking force. For details, refer to the Outline of Regenerative Brake Cooperative Control in the Brake Control System, on page CH-36.

6. Link-Less

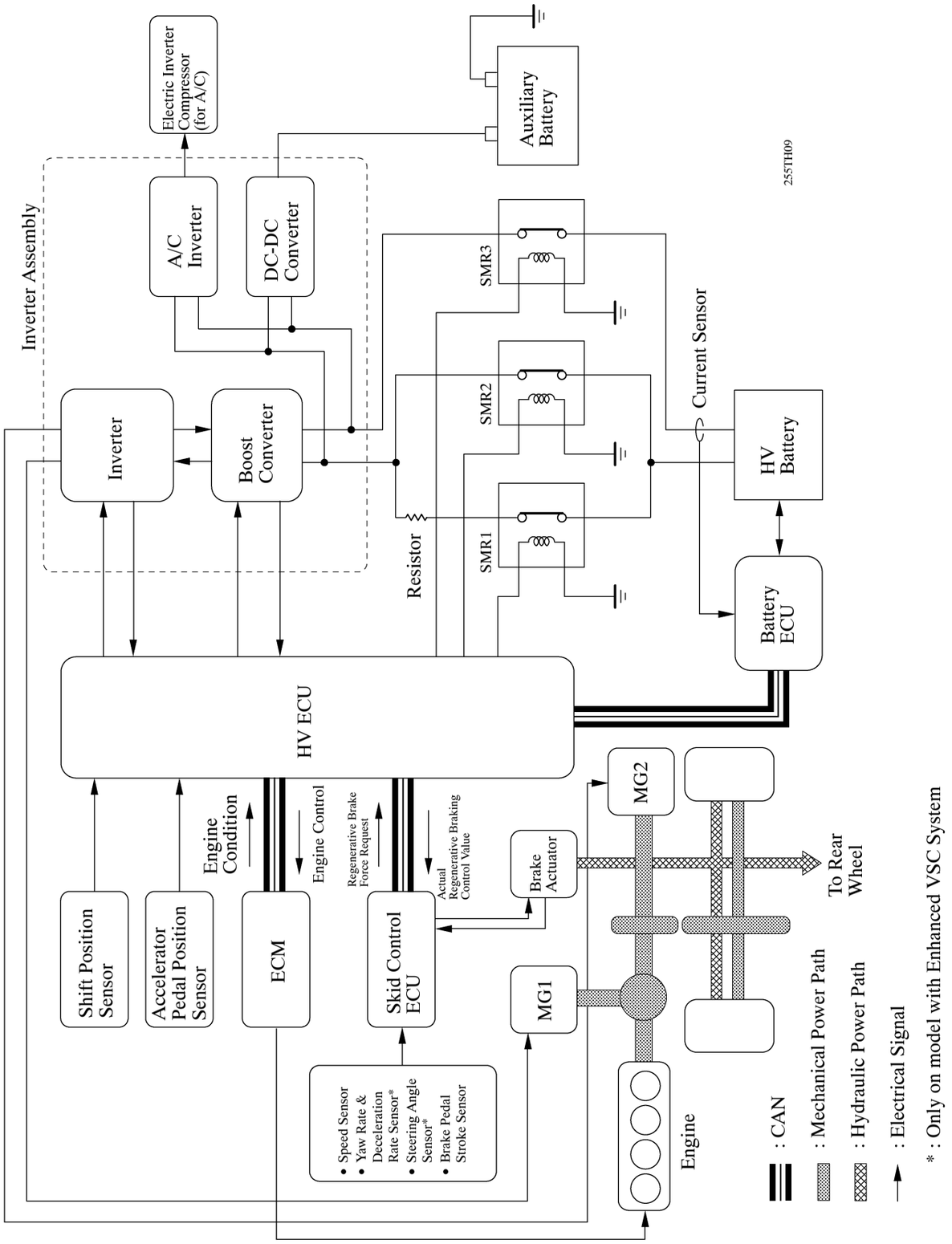
- As on the ’03 Prius, the ’04 Prius has adopted the shift-by-wire technology. This is a link-less type that does not use a shift cable. A shift position sensor is provided in the transmission shift assembly to detect the shift position and send a corresponding signal to the HV ECU. Upon receiving this signal, the HV ECU optimally combines the operation of the engine, MG1, and MG2, in order to produce the respective shift positions (“R”, “N”, “D”, and “B”).
  When the driver presses the Parking switch located on the top of the transmission shift assembly, the “P” position control actuates the shift control actuator located in the hybrid transaxle in order to mechanically lock the counter driven gear, which engages the parking lock. For details, refer to Shift Control Actuator in P112 Hybrid Transaxle on page CH-14.



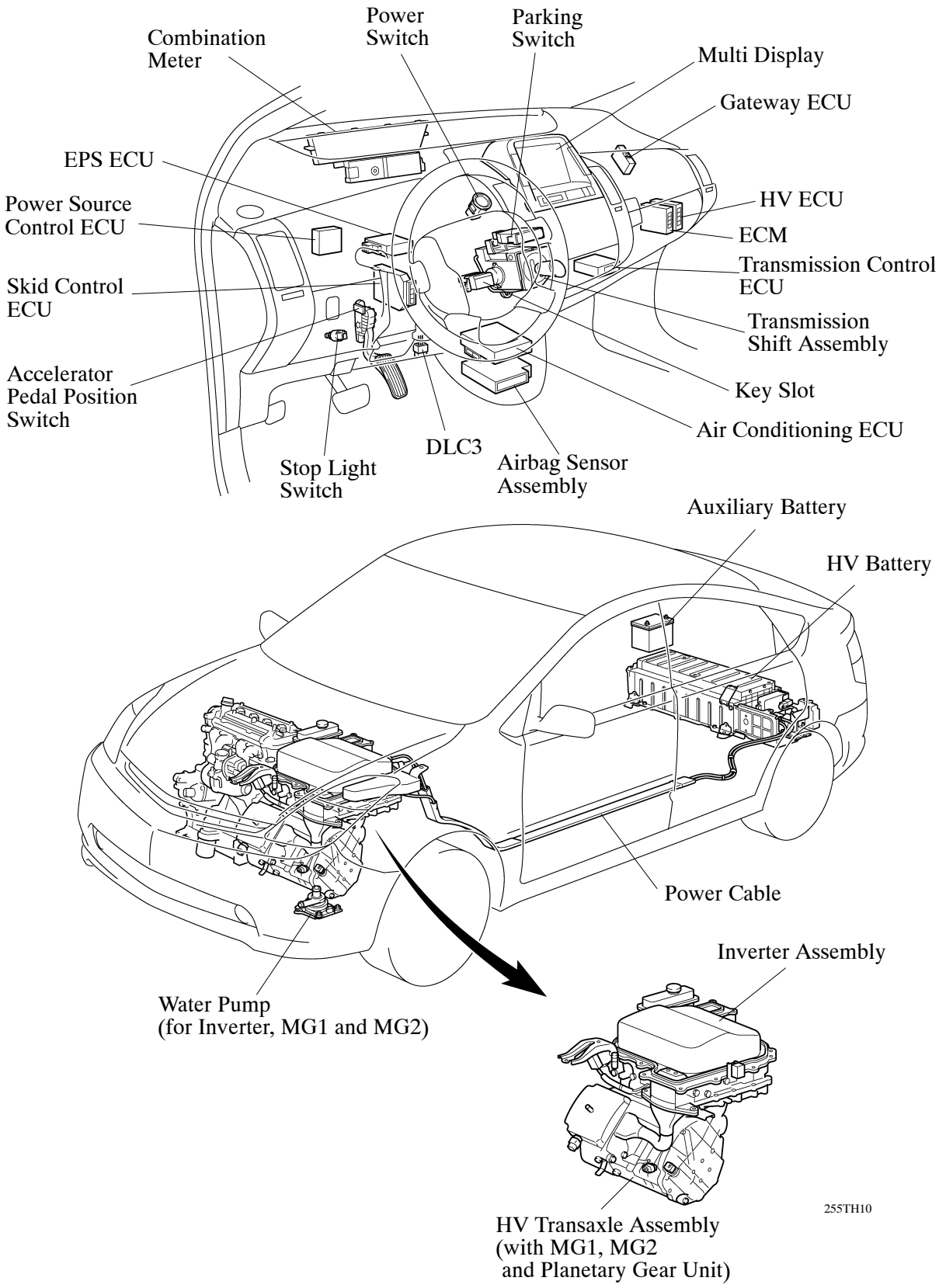
- As on the ’03 Prius, the ’04 Prius has adopted the ETCS-i (Electronic Throttle Control System-intelligent). This is a link-less system that does not use an accelerator cable. Instead, it uses an accelerator pedal position sensor and a throttle position sensor to detect the accelerator pedal position and the throttle position.
  The HV ECU calculates the target engine speed and required engine motive force in accordance with the signals provided by the accelerator pedal position sensor, vehicle driving conditions, and the SOC (state of charge) of the battery, and sends a control signal to the ECM. Based on the control signal, the ECM optimally controls the throttle valve.



■SYSTEM DIAGRAM



■LAYOUT OF MAIN COMPONENTS



■FUNCTION OF MAIN COMPONENTS

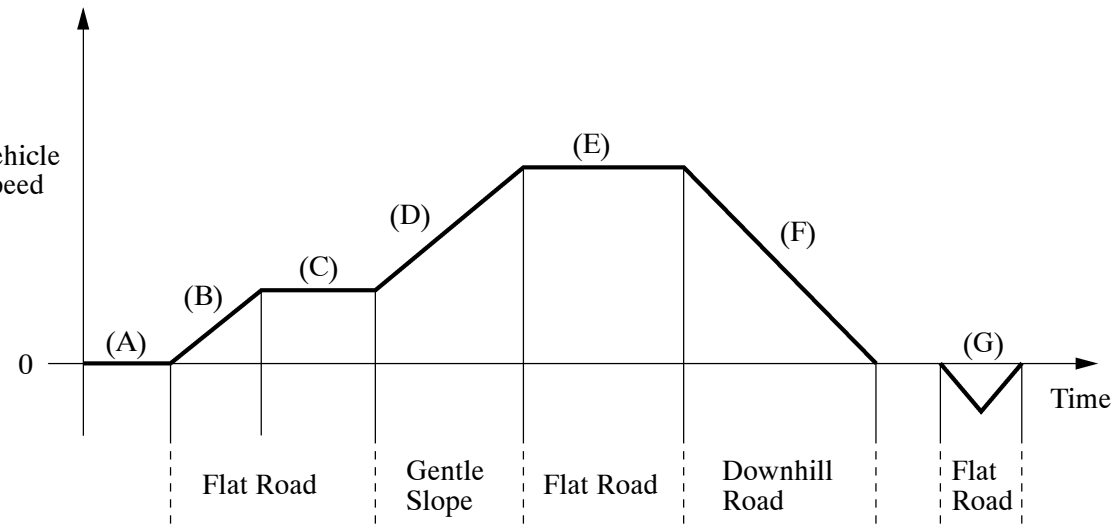
Item		Outline
Hybrid Transaxle	MG1	MG1, which is rotated by the engine, generates high-voltage electricity in order to operate MG2 or charge the HV battery. Also, it functions as a starter to start the engine.
	MG2	• Driven by electrical power from MG1 or HV battery, and generates motive force for the vehicle. • During braking, or when the accelerator pedal is not depressed, it generates electricity to recharge the HV battery (Regenerative brake control).
	Planetary Gear Unit	Distributes the engine's drive force as appropriate to directly drive the vehicle as well as the generator.
HV Battery		Supplies electric power to the MG2 during start-off, acceleration, and uphill driving recharged during braking or when the accelerator pedal is not depressed.
Inverter Assembly		A device that converts the high-voltage DC (HV battery) into AC (MG1 and MG2) and vice versa (Converts AC into DC).
	Boost Converter	Boosts the maximum voltage of the HV battery from DC 201.6 to DC 500V and vice versa (drops DC 500V to DC 201.6V).
	DC-DC Converter	Drops the maximum voltage of DC 201.6 V into DC12 V in order to supply electricity to body electrical components, as well as to recharge the auxiliary battery (DC 12 V).
	A/C Inverter	Converts the nominal voltage of DC 201.6 V of the HV battery to AC 201.6 V and supplies power to operate the electric inverter compressor of the A/C system.
HV ECU		Information from each sensor as well as from the ECU (ECM, Battery ECU, skid control ECU, and EPS ECU) is received, and based on this the required torque and output power is calculated. The HV ECU sends the calculated result to the ECM, inverter assembly, battery ECU and skid control ECU.
ECM		Activates the ETCS-i (Electronic Throttle Control System-intelligent) in accordance with the target engine speed and required engine motive force received from the HV ECU.
Battery ECU		Monitors the charging condition of the HV battery.
Skid Control ECU		Controls the regenerative brake that is effected by the MG2 and the hydraulic brake so that the total braking force equals that of a conventional vehicle that is equipped only with hydraulic brakes. Also, the skid control ECU performs the brake system control (ABS with EBD, Brake Assist, and Enhanced VSC*) conventionally.
Accelerator Pedal Position Sensor		Converts the accelerator angle into an electrical signal and outputs it to the HV ECU.
Shift Position Sensor		Converts the shift position into an electrical signal and outputs it to the HV ECU.
SMR (System Main Relay)		Connects and disconnects the high-voltage power circuit between battery and inverter assembly, through the use of a signal from the HV ECU.
Interlock Switch (for Inverter Cover and Service Plug)		Verifies that the cover of both the inverter and the service plug have been installed.
Circuit Breaker Sensor		The high-voltage circuit is intercepted if a vehicle collision has been detected.
Service Plug		Shuts off the high-voltage circuit of the HV battery when this plug is removed for vehicle inspection or maintenance.

* : Only on model with Enhanced VSC System

■SYSTEM OPERATION

1. General

- The THS-II system uses the two types of motive forces provided by the engine and MG2, and uses MG1 as a generator. The system optimally combines these forces in accordance with the various driving conditions.
- The HV ECU constantly monitors the SOC condition, the battery temperature, the engine coolant temperature, and the electrical load condition. If any one of the monitoring items fails to satisfy requirements when the READY indicator is ON and the shift position is in the “P” position, or the vehicle is driven in reverse, the HV ECU demands to start the engine to drive MG1, and then charges the HV battery.
- Under the preheat operation of the coolant heat storage system on the ’04 Prius, the engine does not start.
- The THS-II system drives the vehicle by optimally combining the operation of the engine, MG1, and MG2 in accordance with the driving conditions listed in the table below.



Driving Condition 255TH88

(A): READY ON State (See Page TH-13)

(B): Starting (See Page TH-15)

(C): During Slight Acceleration with Engine (See Page TH-18)

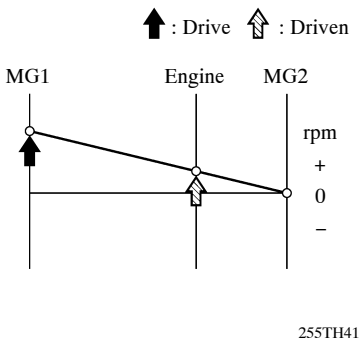
(D): During Low Load Cruising (See Page TH-19)

(E): During Full Throttle Acceleration (See Page TH-20)

(F): During Deceleration Driving (See Page TH-21)

(G): During Reverse Driving (See Page TH-23)

- The nomographic chart below gives a visual representation of the planetary gear's rotational direction, rotational speed, and power balance. In the nomographic chart, the rpm of the 3 gears maintain a relation ship in which they are invariably joined by a direct line.
  This nomographic chart describes the charging or generating conditions of MG1 and MG2, their direction of rotation, and torque conditions as indicated in the table below.

<table>
<tr><th>Condition</th><th>Rotation Direction</th><th>Torque Condition</th><th>Nomographic Chart Example</th></tr>
<tr><td rowspan="2">Discharging</td><td>Forward Revolution
Plus Side</td><td>Plus Torque
Upward Arrow</td><td> 
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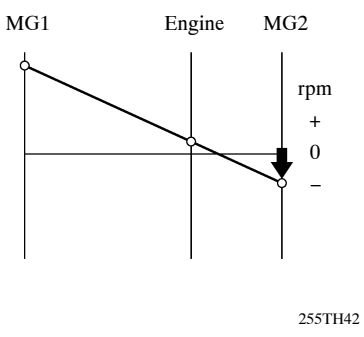
<tr><td>Reverse Revolution
Minus Side</td><td>Minus Torque
Downward Arrow</td><td> 
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<tr><td>Generating</td><td>Forward Revolution
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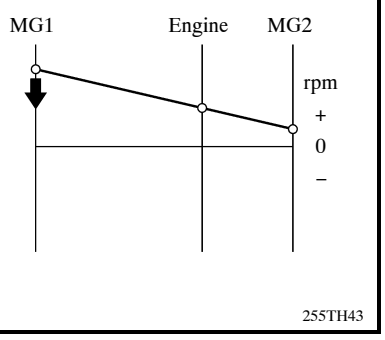
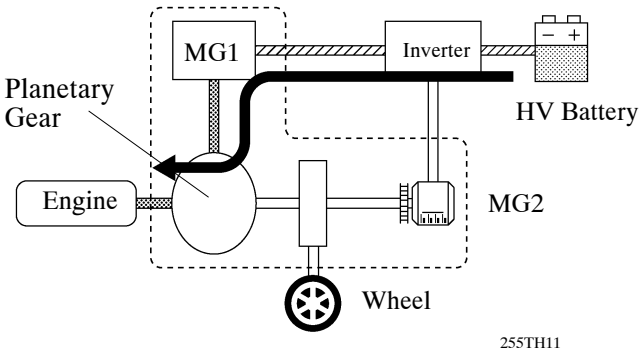
Downward Arrow</td><td> 
</td></tr>
</table>

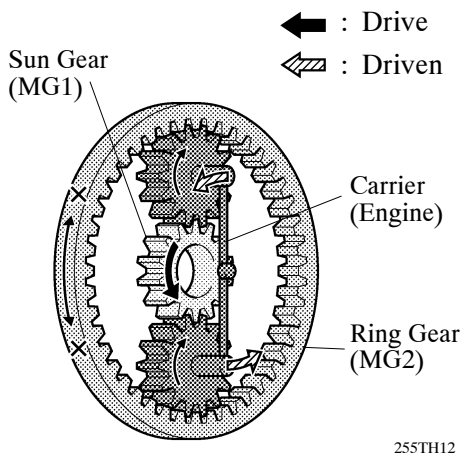
2. READY ON State / (A)

- On the ’04 Prius, even if the driver presses on the POWER switch and the READY indicator turns ON, the engine will not start unless the proper engine coolant temperature, SOC conditions, battery temperature and electrical road conditions have been met. In this state, the engine, MG1, and MG2 are all stopped.
- After driving, if the driver stops the vehicle and moves the shift position to the “P”, the HV ECU will continue to operate the engine for a predetermined length of time and will bring the engine to a stop, provided that the proper engine coolant temperature, SOC conditions, battery temperature and electrical road conditions have been met. At this time, the engine, MG1, and MG2 are all stopped.

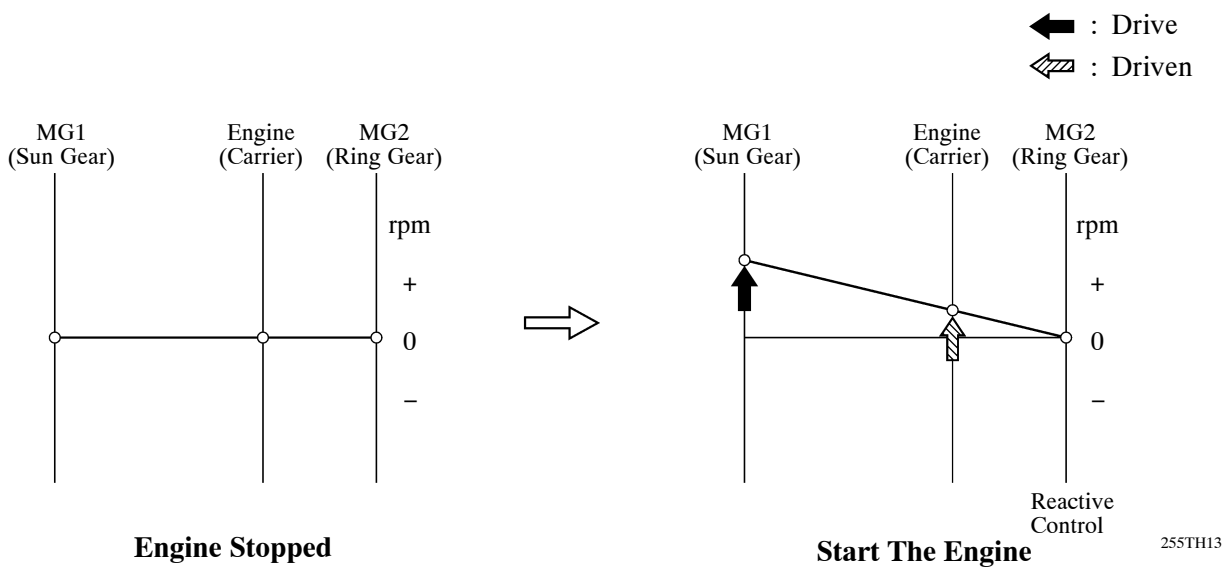
Start The Engine

- If any one of the items monitored by the HV ECU fails to satisfy requirements when the READY indicator is ON and the shift position is in the “P” position, or the vehicle is driven in reverse, the HV ECU activates MG1 to start the engine.
- During this operation, to prevent the reactive force of the sun gear of MG1 from rotating the ring gear of MG2 and driving the drive wheels, an electrical current is applied to MG2 in order to apply a brake. This function is called “reactive control”.

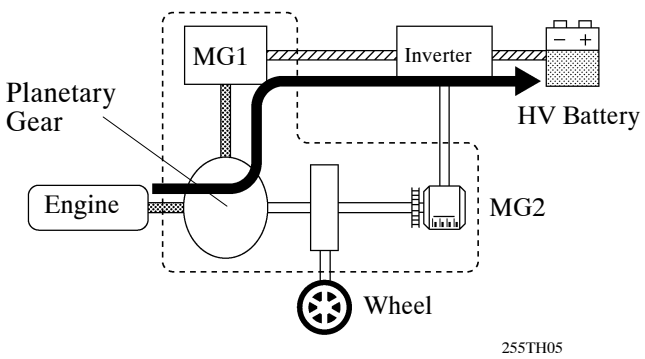


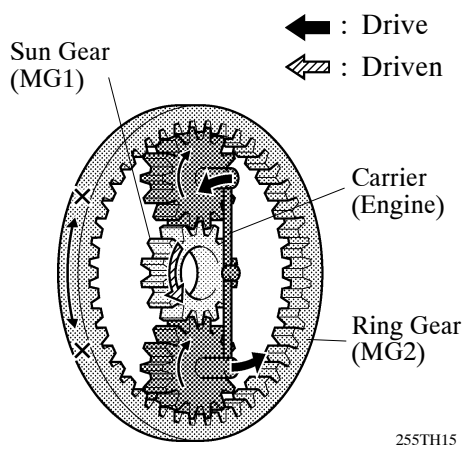


▶ Nomographic Chart of Planetary Gear Unit ◀

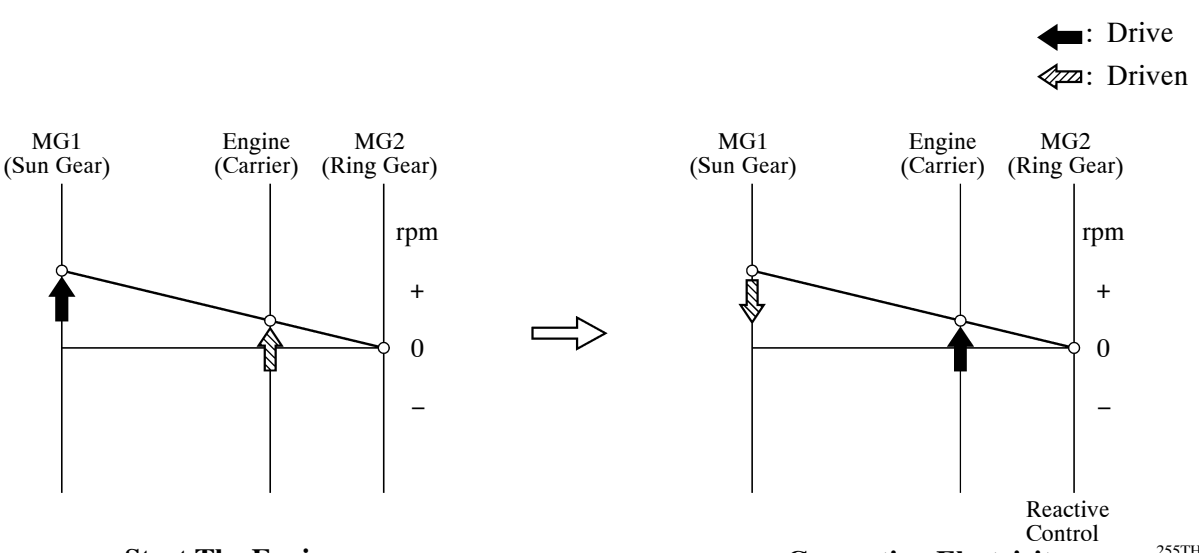


- In the next state, the engine that is running starts to operate MG1 as a generator, which starts to generate the HV battery.





▶ Nomographic Chart of Planetary Gear Unit ◀

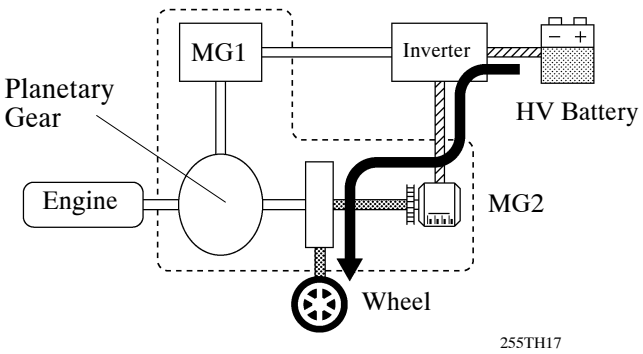


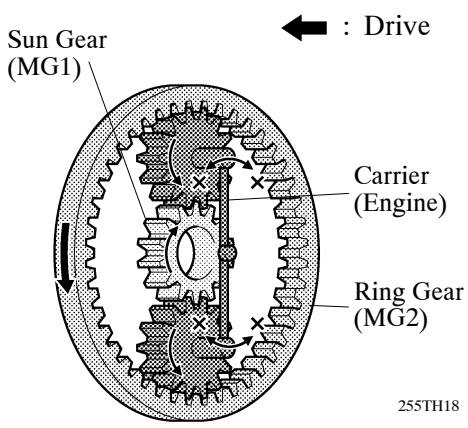
Start The Engine **Generating Electricity**

3. Starting / (B)

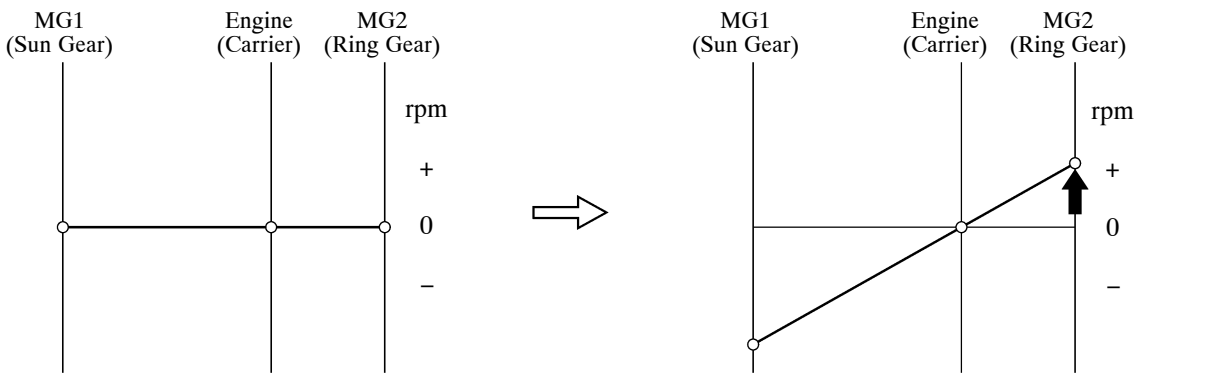
Driving With MG2

When the vehicle is started off, the vehicle operates powered only by MG2. At this time, the engine remains stopped, and MG1 is spinning in the opposite direction without generating electricity.



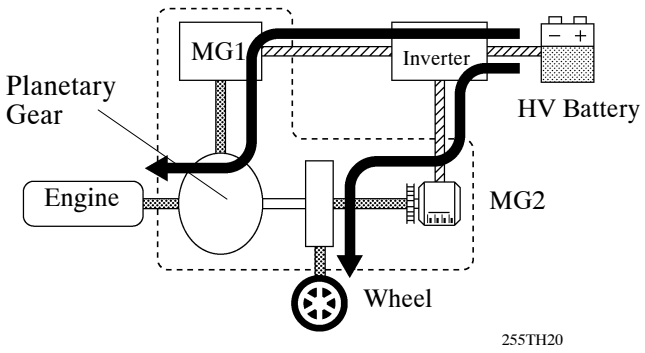


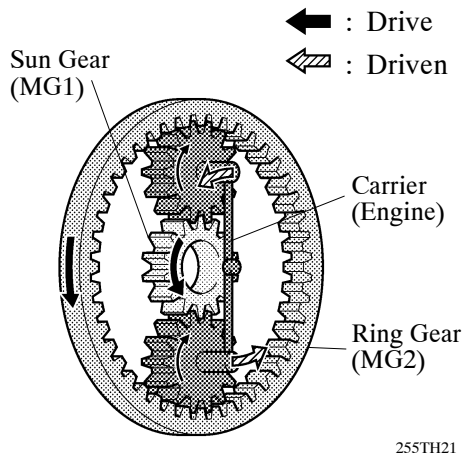
▶ Nomographic Chart of Planetary Gear Unit ◀



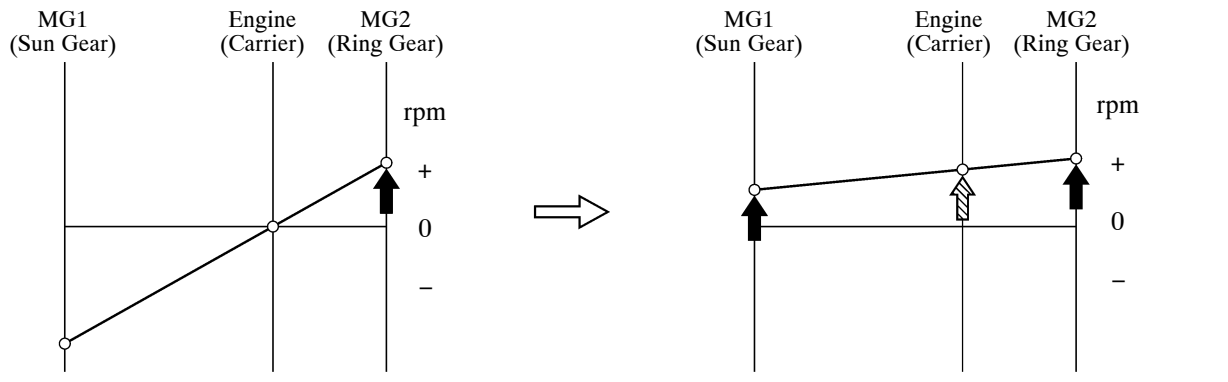
Start The Engine

- If the required drive torque increases when running with MG2 only, MG1 will be activated to start the engine. If, also, any one of the items monitored by the HV ECU such as the SOC condition, the battery temperature, the engine coolant temperature and the electrical load condition deviates from the specified level, MG1 will be activated to start the engine.



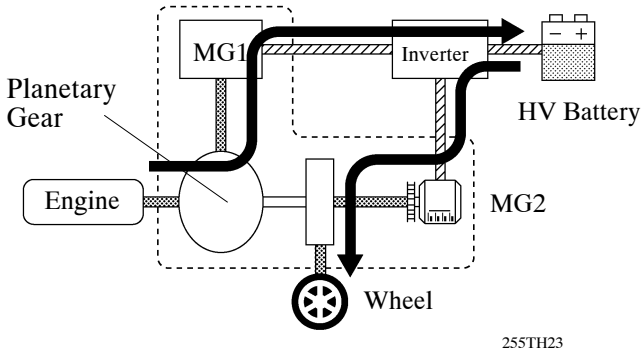


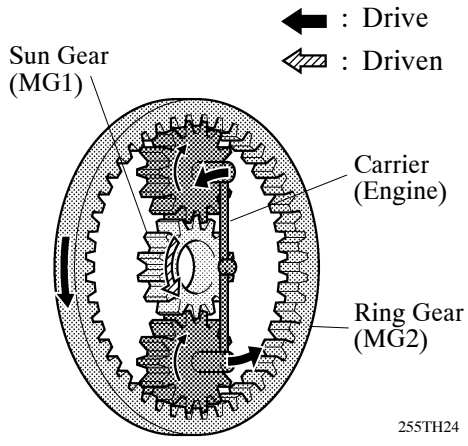
▶ Nomographic Chart of Planetary Gear Unit ◀



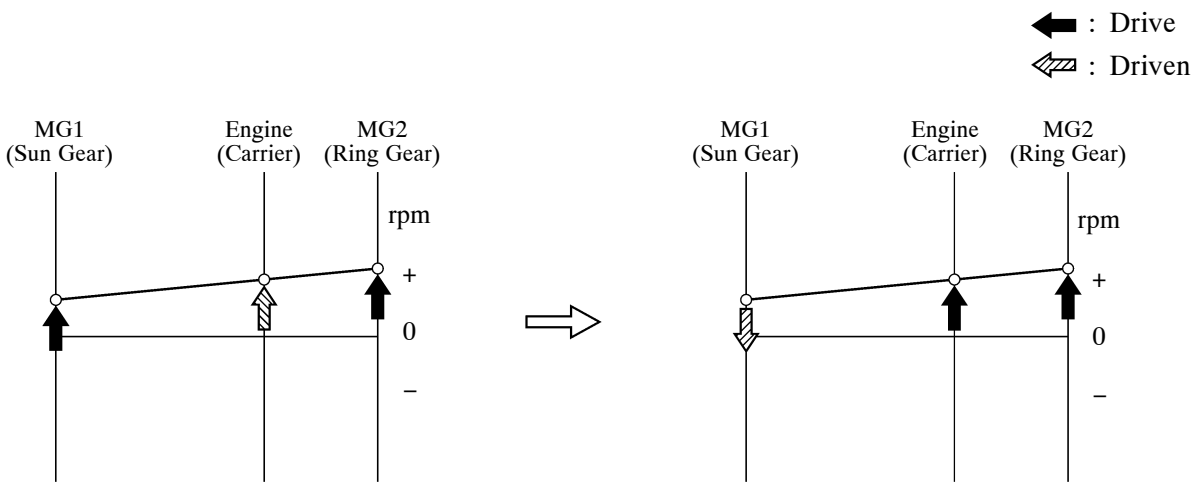
Vehicle Starting Off **Start The Engine**

- In the next state, the engine that has been started will operate MG1 as a generator, in order to start charging the HV battery. If the required drive torque increases, the engine will start driving MG1 as a generator, in order to transfer to the “During Slight Acceleration with Engine” mode.





▶ Nomographic Chart of Planetary Gear Unit ◀

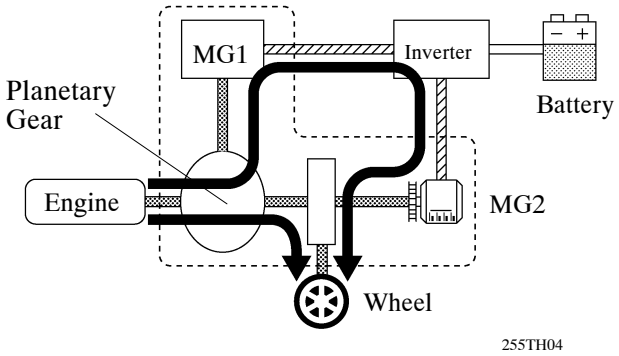


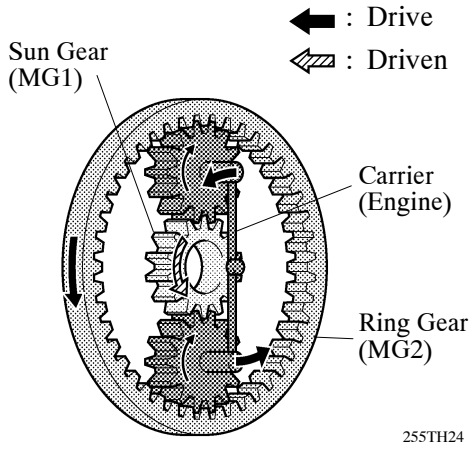
Start The Engine **Generating Electricity**

255TH22

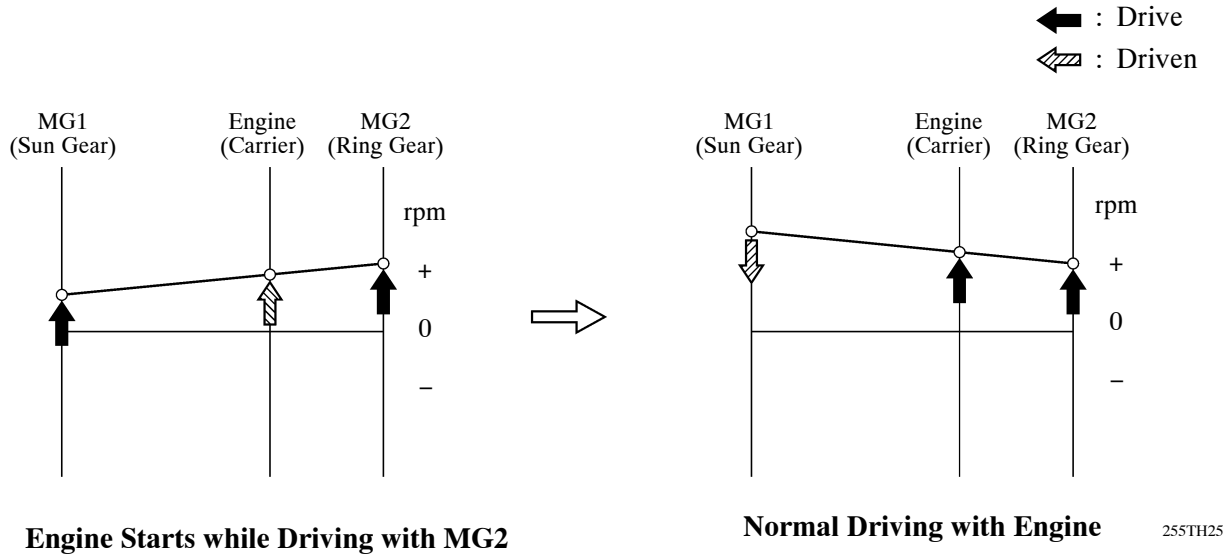
4. During Slight Acceleration with Engine / (C)

When the vehicle is during slight acceleration with engine, the motive force of the engine is divided by the planetary gears. A portion of this motive force is output directly, and the remaining motive force is used for generating electricity through MG1. Through the use of an electrical path of an inverter, this electrical force is sent to MG2 to be output as the motive force of MG2.





▶ Nomographic Chart of Planetary Gear Unit ◀

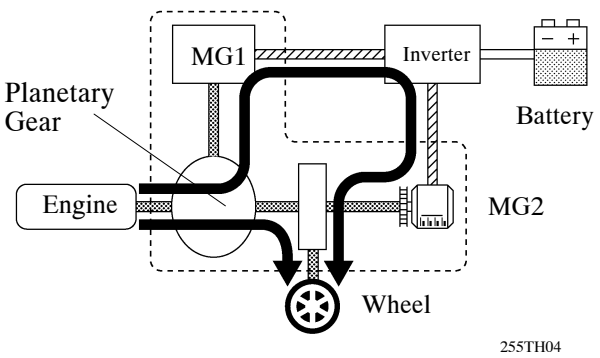


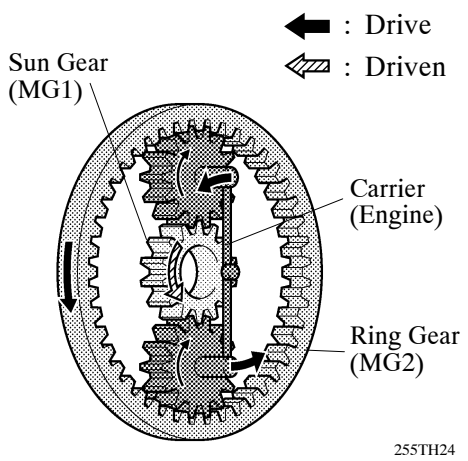
Engine Starts while Driving with MG2

Normal Driving with Engine

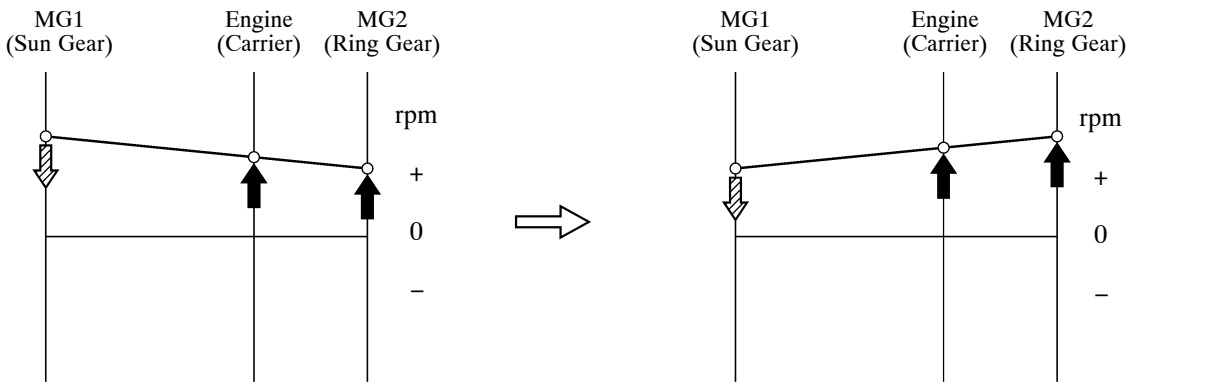
5. During Low Load Cruising / (D)

When the vehicle is during low load cruising, the motive force of the engine is divided by the planetary gears. A portion of this motive force is output directly, and the remaining motive force is used for generating electricity through MG1. Through the use of an electrical path of an inverter, this electrical force is sent to MG2 to be output as the motive force of MG2.





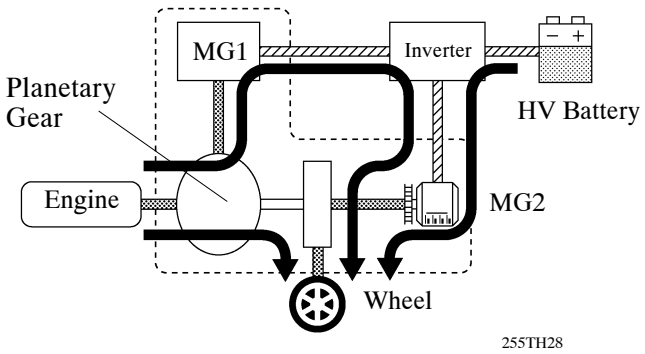
▶ Nomographic Chart of Planetary Gear Unit ◀

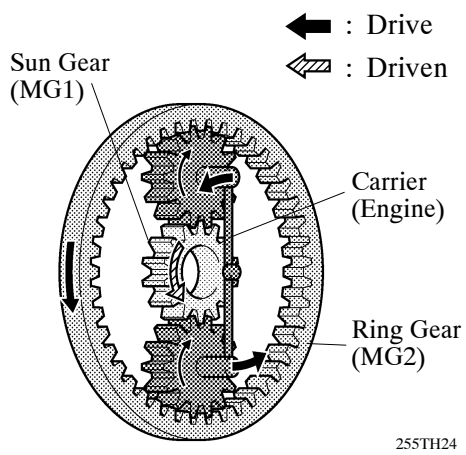


Normal Driving with Engine **Low Load Cruising**

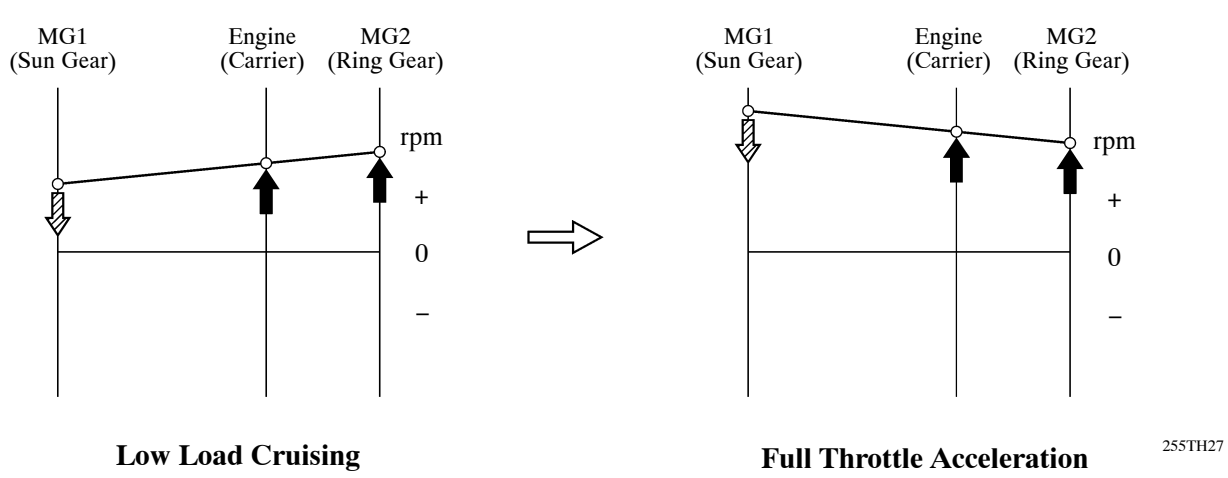
6. During Full Throttle Acceleration / (E)

When the vehicle transfers from the low load cruising to the full-throttle acceleration mode, the system will add the electrical force of the HV battery to the motive force of MG2.





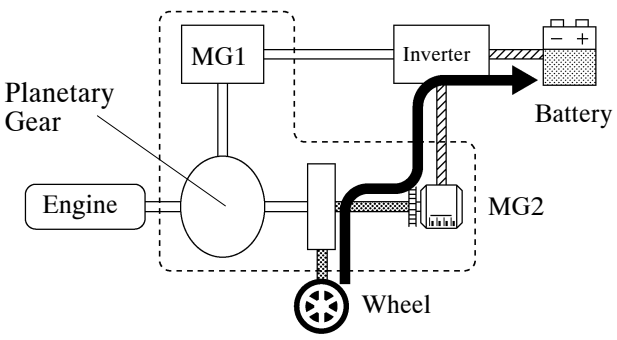
▶ Nomographic Chart of Planetary Gear Unit ◀

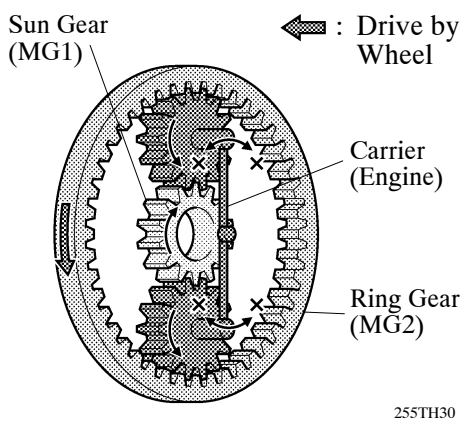


7. During Deceleration Driving / (F)

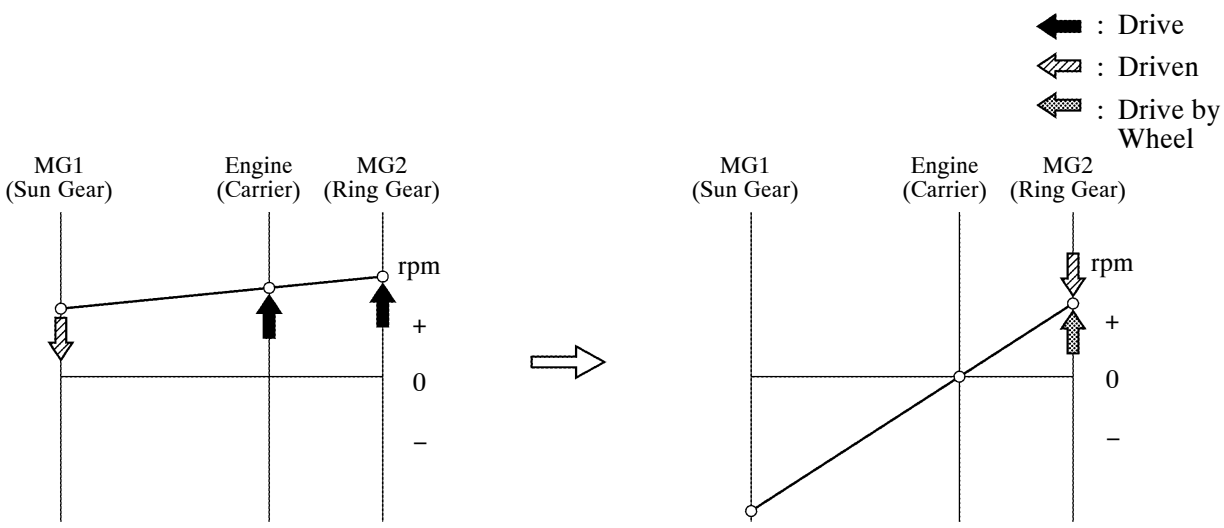
Deceleration in “D” Range

- While the vehicle is being driven with the shift position in the D, and decelerates, the engine turns OFF and the motive force will be zero. At this time, the wheels drive MG2, causing MG2 to operate as a generator and charge the HV battery.
- If the vehicle decelerates from a higher speed, the engine will maintain a predetermined speed without stopping, in order to protect the planetary gear unit.





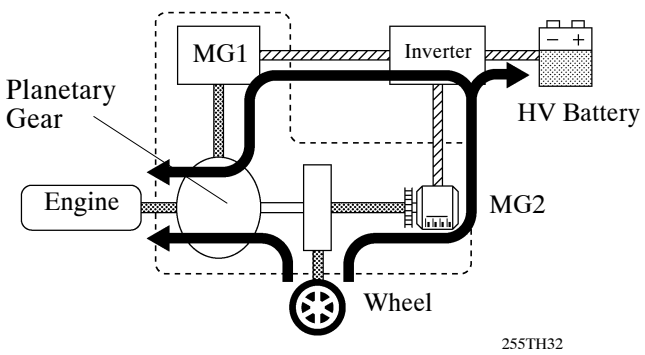
▶ Nomographic Chart of Planetary Gear Unit ◀

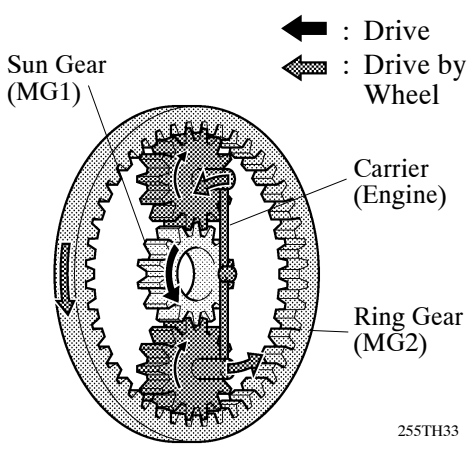


Low Load Cruising **Deceleration Driving**

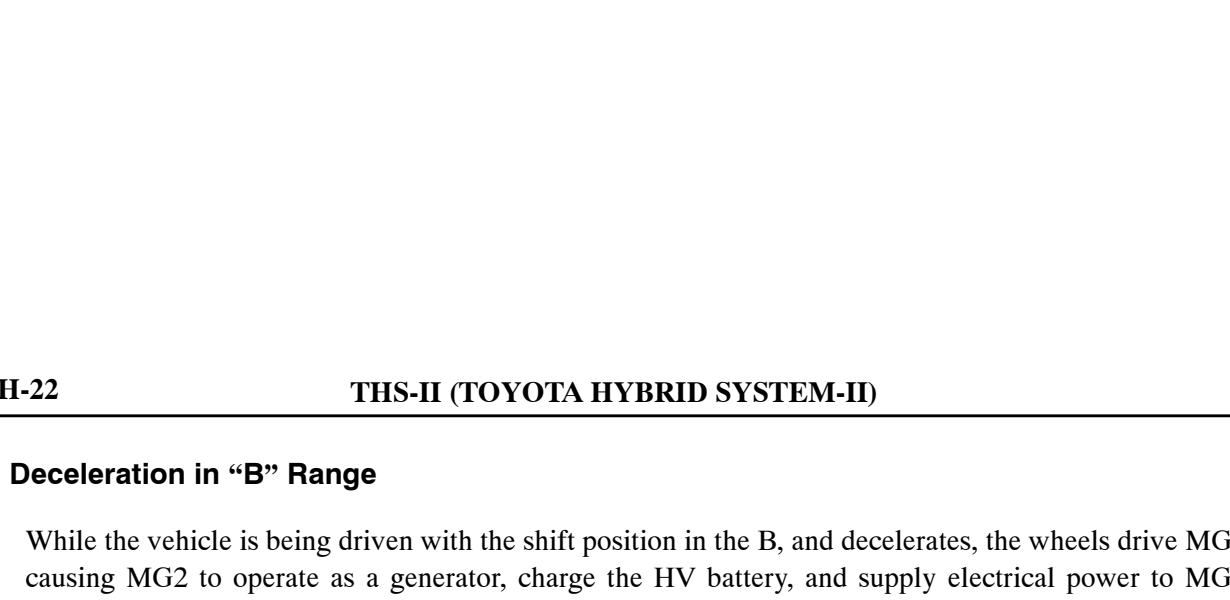
Deceleration in “B” Range

While the vehicle is being driven with the shift position in the B, and decelerates, the wheels drive MG2, causing MG2 to operate as a generator, charge the HV battery, and supply electrical power to MG1. Accordingly, MG1 maintains the speed of the engine and applies an engine brake. At this time, the fuel to the engine is cut.





▶ Nomographic Chart of Planetary Gear Unit ◀



Low Load Cruising **Deceleration Driving**

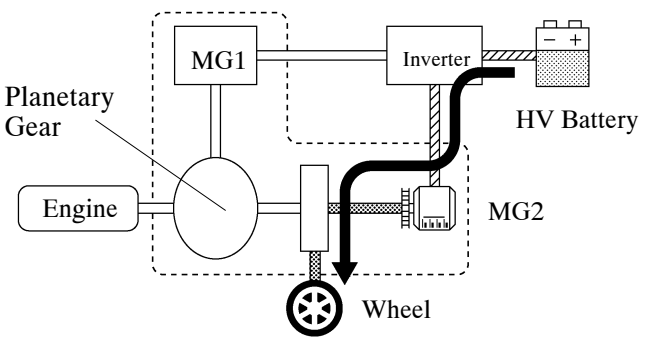
During Braking

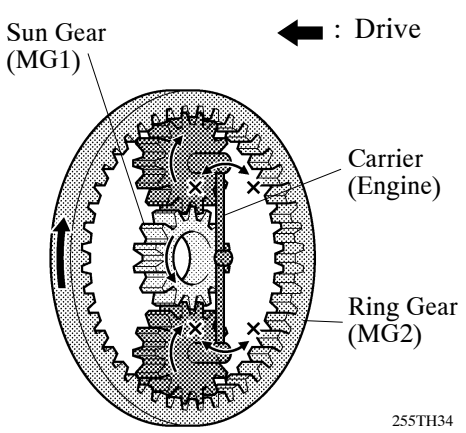
While the vehicle is decelerating, if the driver presses the brake pedal, the skid control ECU calculates the required regenerative brake force and sends a signal to the HV ECU. Upon receiving this signal, the HV ECU increases the regenerative force within a range that suits the required regenerative brake force. As a result, MG2 will be controlled to generate an ample amount of electricity.

8. During Reverse Driving / (G)

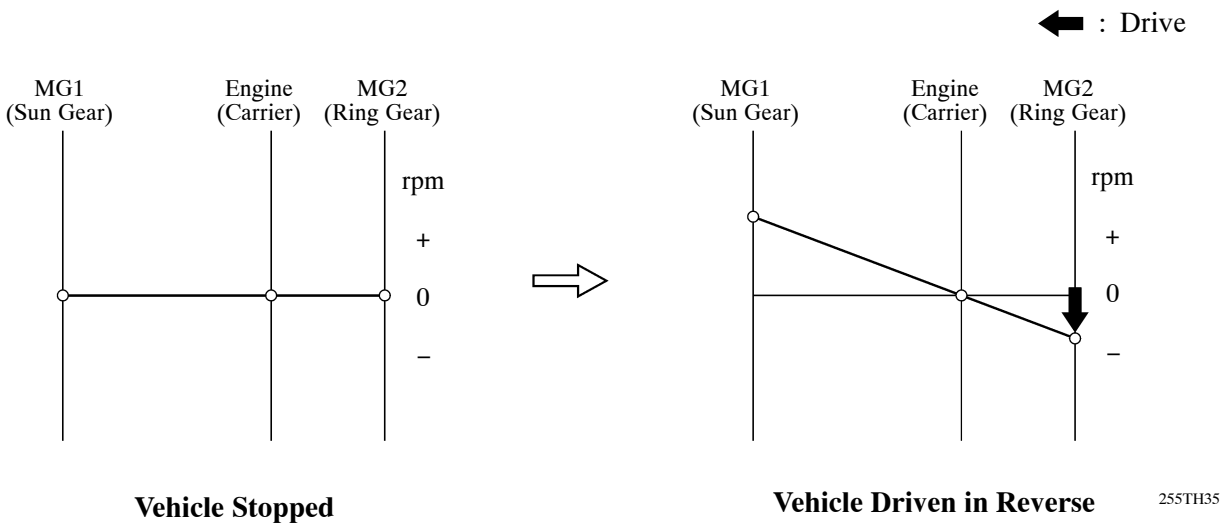
Driving With MG2

When the vehicle is during reverse driving, the vehicle operates powered only by MG2. At this time, MG2 is spinning in the opposite direction, the engine remains stopped, and MG1 is spinning in the normal direction without generating electricity.



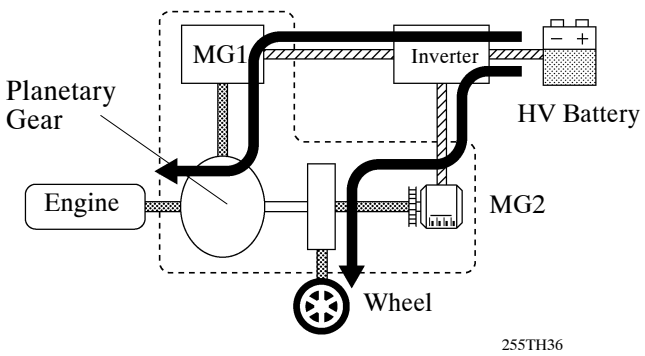


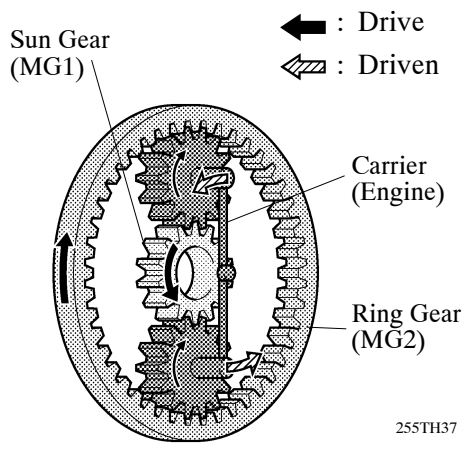
▶ Nomographic Chart of Planetary Gear Unit ◀



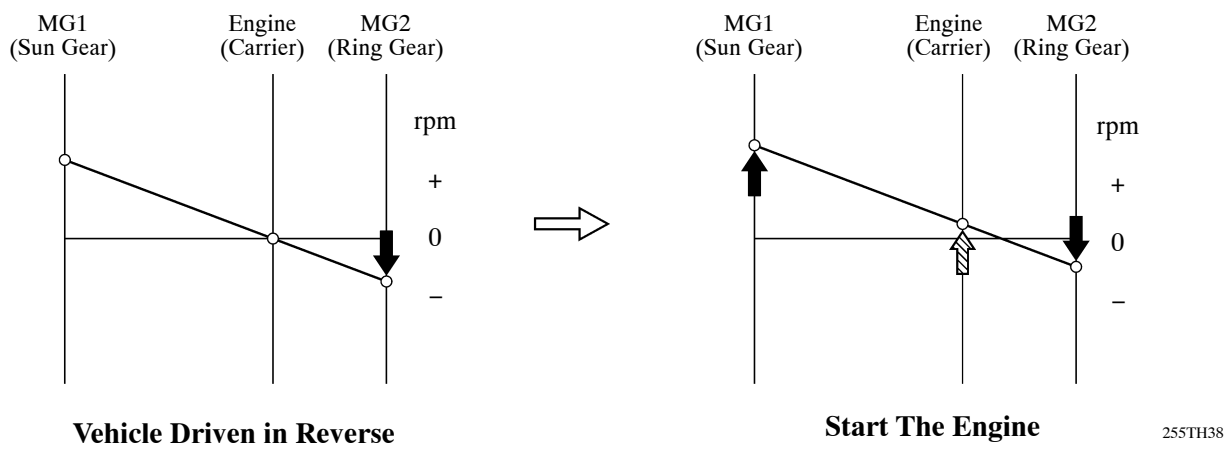
Start The Engine

- If, when running with MG2 only, any one of the items monitored by the HV ECU such as the SOC condition, the battery temperature, the engine coolant temperature and the electrical load condition deviates from the specified level, MG1 will be activated to start the engine.

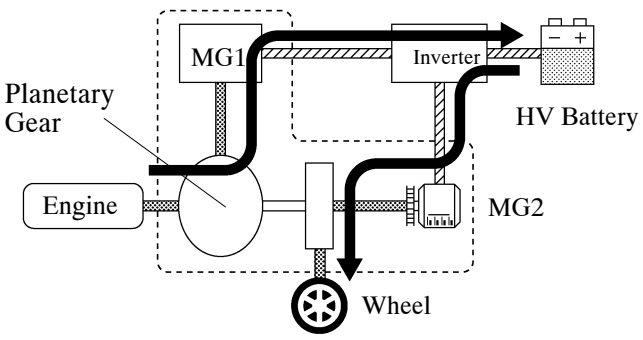


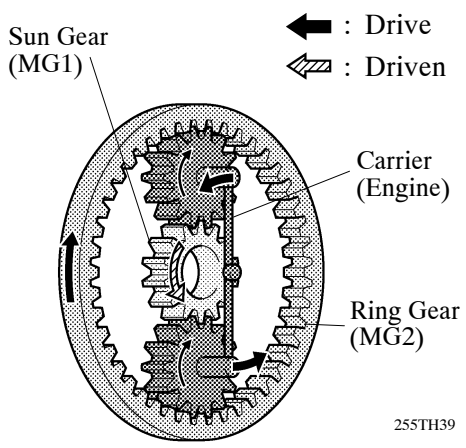


▶ Nomographic Chart of Planetary Gear Unit ◀

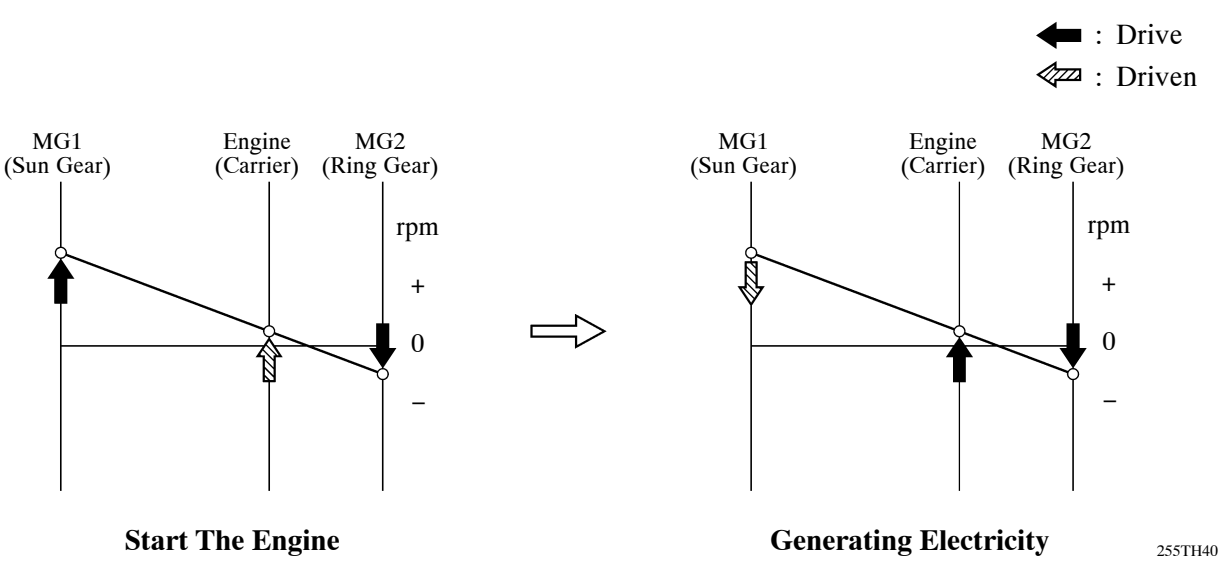


- In the next state, the engine that has been started will operate MG1 as a generator, in order to start charging the HV battery.





▶ Nomographic Chart of Planetary Gear Unit ◀



Start The Engine **Generating Electricity**

255TH40

■CONSTRUCTION OF MAIN COMPONENTS

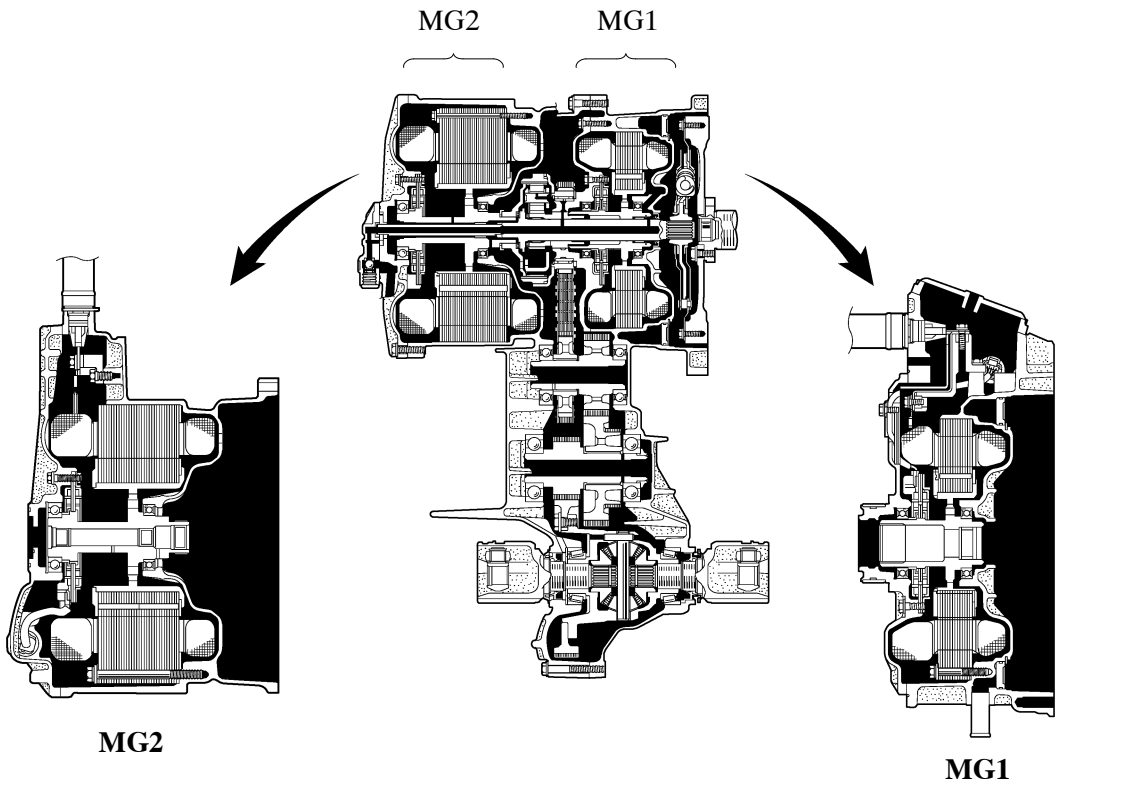
1. MG1 and MG2

General

- Both the MG1 (Motor Generator No. 1) and the MG2 (Motor Generator No. 2) are compact, lightweight, and highly efficient alternating current permanent magnet synchronous type.
- Serving as the source of supplemental motive force that provides power assistance to the engine as needed, the electric motor helps the vehicle achieve excellent dynamic performance, including smooth start-offs and acceleration. When the regenerative brake is activated, MG2 converts the vehicle's kinetic energy into electrical energy, which is then stored in the HV battery.
- MG1 recharges the HV battery and supplies electrical power to drive MG2. In addition, by regulating the amount of electrical power generated (thus varying the generator's rpm), MG1 effectively controls the continuously variable transmission function of the transaxle. MG1 also serves as the starter to start the engine.
- A cooling system via water pump for the MG1 and MG2 has been added. For details, refer to cooling system (for Inverter, MG1 and MG2) on page TH-34.

— Main Changes from '03 Prius —

- Accompanied by enhancing the rotor robustness of MG1, its rpm range for the maximum possible output has been increased from 6,500 to 10,000 rpm, therefore the charging capability has been enhanced.
- Structure of each built-in permanent magnet inside the rotor of MG2 has been optimized by redesigning it to V shaped structure, and improvement of its power output and torque has been realized.
- For MG2 control, a newly developed over-modulation control system has been adopted to the medium-speed range.



255TH49

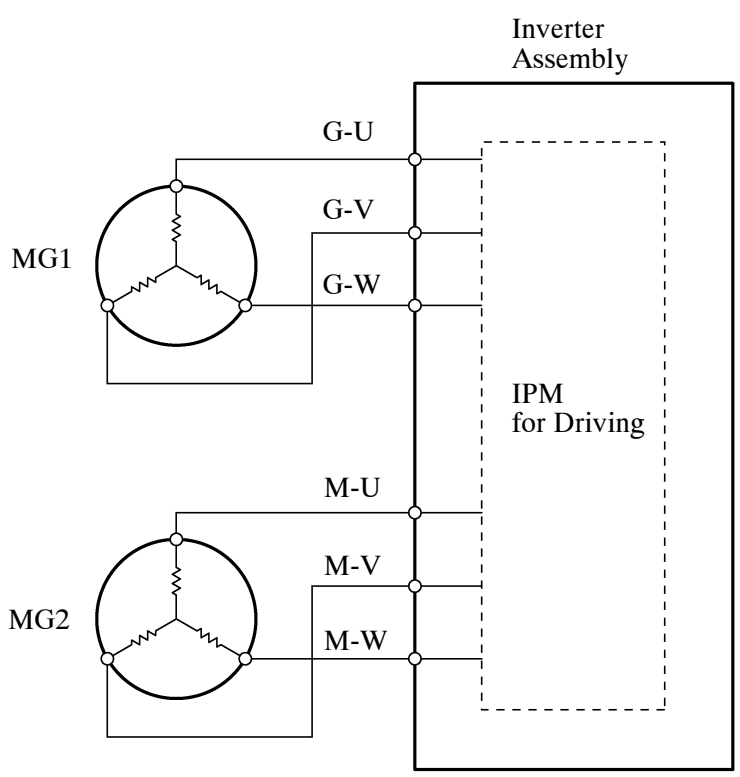
▶ MG1 Specifications ◀

Item		’04 Model	’03 Model
Type		Permanent Magnet Motor	←
Function		Generate, Engine Starter	←
Maximum Voltage	[V]	AC 500	AC 273.6
Cooling system		Water-cooled	←

▶ MG2 Specifications ◀

Item		’04 Model	’03 Model
Type		Permanent Magnet Motor	←
Function		Generate, Drive Wheels	←
Maximum Voltage	[V]	AC 500	AC 273.6
Maximum Output	kW (PS) / rpm	50 (68) / 1,200 ~ 1,540	33 (45) / 1,040 ~ 5,600
Maximum Torque	N·m (kgf·m) / rpm	400 (40.8) / 0 ~ 1,200	350 (35.7) / 0 ~ 400
Cooling system		Water-cooled	←

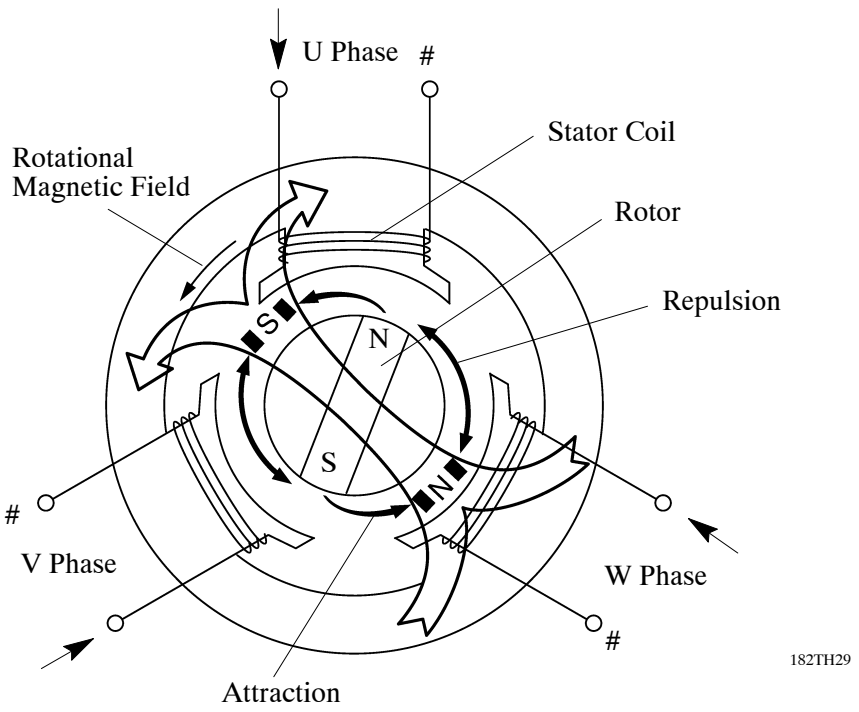
▶ System Diagram ◀



255TH81

Permanent Magnet Motor

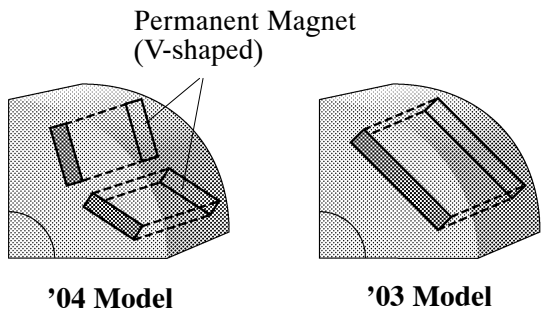
- When a three-phase alternating current is passed through the three-phase windings of the stator coil, a rotational magnetic field is created in the electric motor. By controlling this rotating magnetic field according to the rotor's rotational position and speed, the permanent magnets that are provided in the rotor become attracted by the rotating magnetic field, thus generating torque.
  The generated torque is for all practical purposes proportionate to the amount of current, and the rotational speed is controlled by the frequency of the alternating current.
  Furthermore, a high level of torque, all the way to high speeds, can be generated efficiently by properly controlling the rotating magnetic field and the angles of the rotor magnets.



182TH29

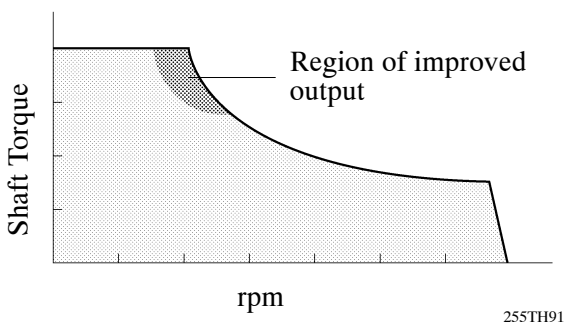
→ : From inverter
: Connected internally in the motor

- On '04 Prius, structure of each built-in permanent magnet inside the rotor of MG2 has been optimized by redesigning it to V-shaped structure to improve both power output and torque of the rotor. By power output, it has been improved by approximately 50 % more power as the one of '03 Prius.



255TH90

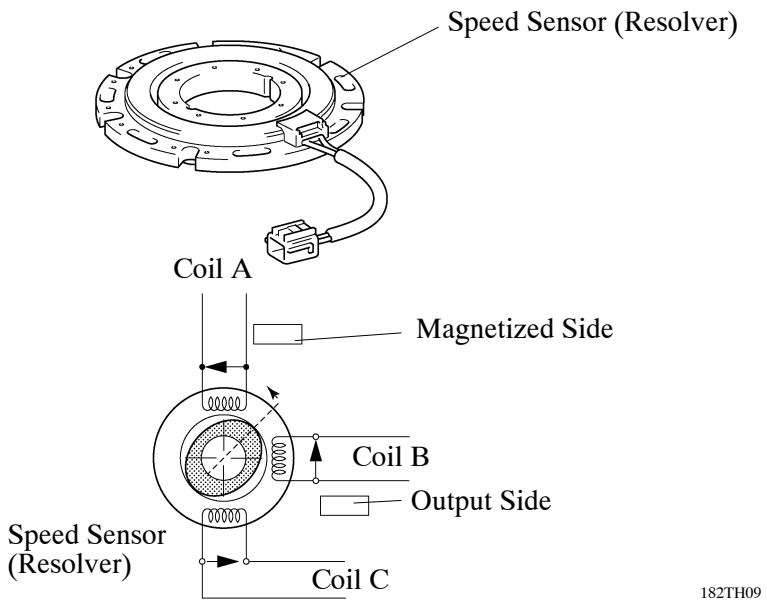
- For MG2 control, a newly developed over-modulation control system has been adopted to the medium-speed range, in addition to the existing low- and high-speed control methods. By improving the pulse width modification method, the output in the medium-speed range has been increased by a maximum of approximately 30 %.



255TH91

Speed Sensor / Resolver

This is an extremely reliable and compact sensor that precisely detects the magnetic pole position, which is indispensable for ensuring the efficient control of MG1 and MG2.
The sensor's stator contains 3 coils as illustrated, and output coils B and C are electrically staggered 90 degrees. Because the rotor is oval, the distance of the gap between the stator and the rotor varies with the rotation of the rotor. Thus, by passing an alternating current through coil A, output that corresponds to the sensor rotor's position is generated by coil B and C. The absolute position can then be detected from the difference between these outputs.
In addition, the amount of positional variance within a predetermined time is calculated by the HV ECU, thus enabling this sensor to be used as an rpm sensor.



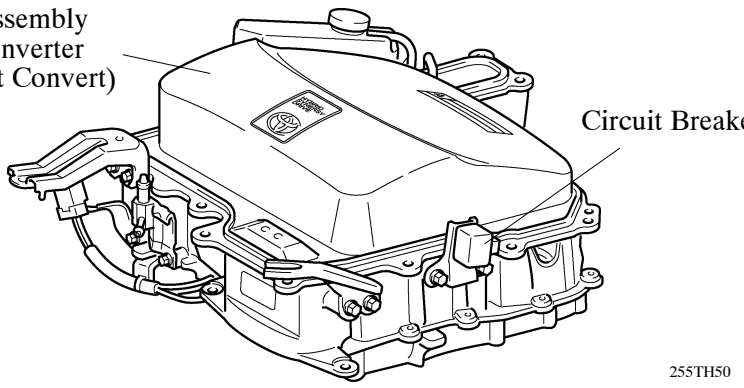
2. Inverter Assembly

General

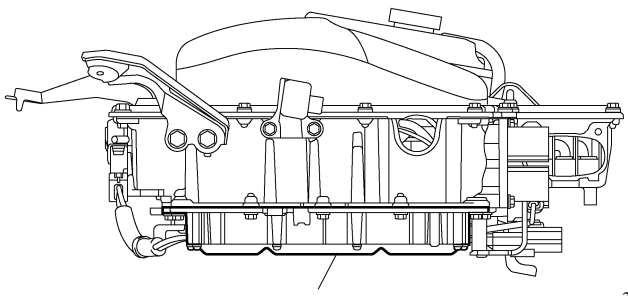
- The inverter converts the high-voltage direct current of the HV battery into three-phase alternating current for driving MG1 and MG2.
- The activation of the power transistors is controlled by the HV ECU. In addition, the inverter transmits information that is needed for current control, such as the output amperage or voltage, to the HV ECU.
- Together with MG1 and MG2, the inverter is cooled by the dedicated radiator of the coolant system that is separate from that of the engine.
- In the event of a collision involving the vehicle, the circuit breaker sensor, which is installed in the inverter, detects a collision signal in order to stop the system. For details, refer to During Collision Control on page TH-56.

— Main Changes from '03 Prius —

- A boost converter has been adopted in the inverter assembly, in order to boost the nominal voltage output by the HV battery from DC 201.6 V to maximum voltage of DC 500 V. After the voltage is boosted, the inverter converts the direct current into an alternating current.
- The bridge circuits for MG1 and MG2 (each consisting of 6 power transistors), and the signal processor/protective function processor have been integrated into a compact IPM (Intelligent Power Module) for driving the vehicle.
- An A/C inverter that supplies power to drive an electric inverter compressor for the A/C system has been included in the inverter assembly.
- A radiator that integrates an inverter radiator and engine radiator has been adopted to optimize the space it occupies.

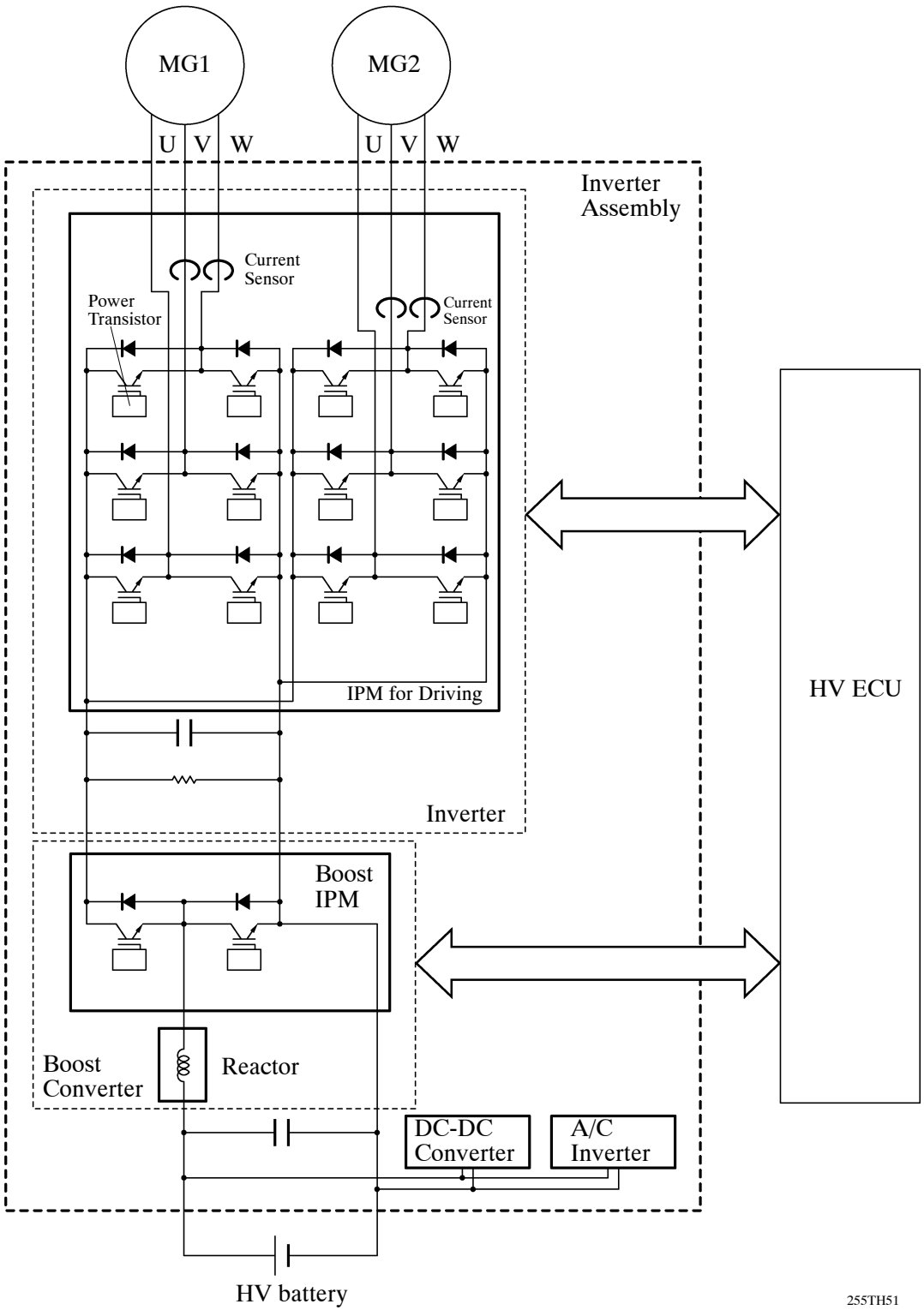


255TH50



255TH54

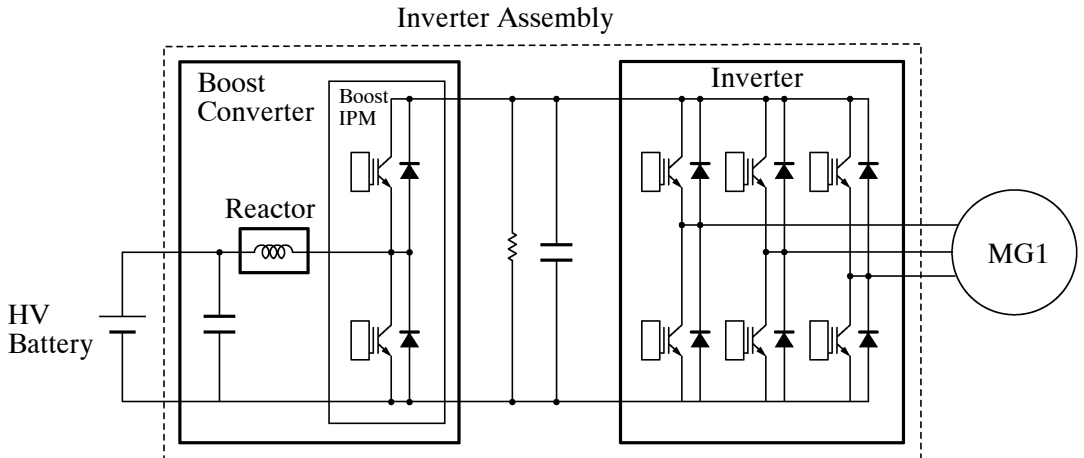
▶ System Diagram ◀



Boost Converter

- This boost converter boosts the nominal voltage of DC 201.6 V that is output by the HV battery to the maximum voltage of DC 500 V. The converter consists of the boost IPM (Integrated Power Module) with a built-in IGBT (Insulated Gate Bipolar Transistor) which performs the switching control, and the reactor which stores energy. By using these components, the converter boosts the voltage.
- When MG1 or MG2 acts as the generator, the inverter converts the alternating current (range of 201.6 to 500 V) generated by either of them into the direct current, and then the boost converter drops it to DC 201.6 V, thus the HV battery is charged.

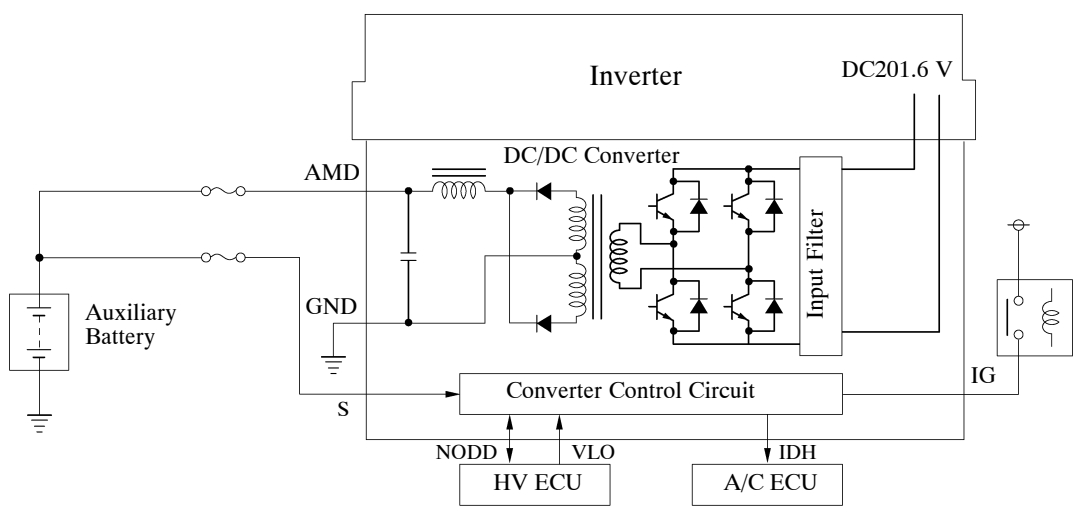
▶ System Diagram ◀



DC/DC Converter

The power source for auxiliary equipment of the vehicle such as the lights, audio system, and the air conditioning system (except A/C compressor), as well as the ECUs, is based on a DC 12 V system. Because the THS-II generator outputs at nominal voltage of DC 201.6 V, the converter is used to transform the voltage from DC 201.6 V to DC 12 V in order to recharge the auxiliary battery. The converter is installed on the underside of the inverter.

▶ System Diagram ◀

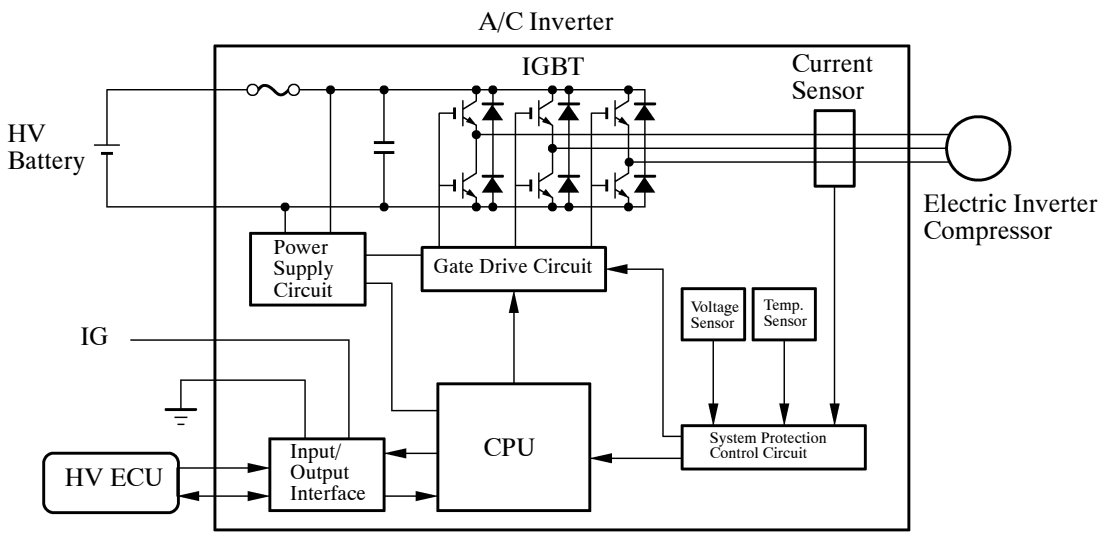


255TH92

A/C Inverter

An A/C inverter, which supplies power for driving the electric inverter compressor of the A/C system, has been included in the inverter assembly.
This inverter converts the HV battery's nominal voltage of DC 201.6 V into AC 201.6 V and supplies power to operate the compressor of the A/C system.

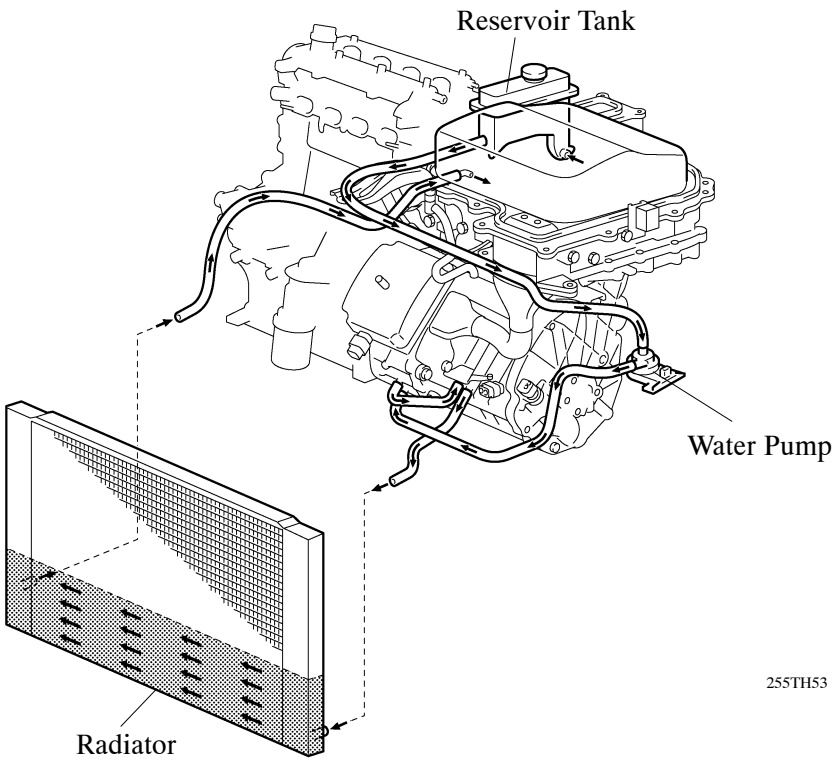
▶ System Diagram ◀



255TH93

3. Cooling System (for Inverter, MG1 and MG2)

- A cooling system via water pump for the inverter, MG1 and MG2 has been adopted. It is separated with the engine cooling system.
- This cooling system activates when the power supply status is switched to IG.
- The radiator for the cooling system is integrated with the radiator for the engine. Accordingly, the radiator has been simplified and the space it occupies has been optimized.



▶ Specifications ◀

Water Pump	Discharge Volume liter / min.		10 or above (65 °C (149 °F))
Coolant	Capacity liters (US qts, Imp. qts)		2.7 (2.9, 2.4)
	Type		TOYOTA Genuine Super Long Life Coolant (SLLC) or Equivalent
	Color		Pink
	Maintenance Intervals	First Time	100,000 mile (160,000 km)
		Subsequent	Every 50,000 mile (80,000 km)*

*: Applied only when SLLC (pink-colored) is used. If LLC (red-colored) is used, the maintenance interval would be 25,000 mile (40,000 km) or 24 months whichever comes first.

Service Tip

- When replacing SLLC, drain old coolant from the drain plug located on the lower potion of the hybrid transaxle. For details, refer to the 2004 Prius Repair Manual (Pub. No. RM1075U).
- The above-mentioned maintenance intervals become inaccurate in those cases where coolant other than SLLC has been used to replenish coolant levels between interval periods.
- You can also apply the new maintenance interval (every 50,000 mile (80,000 km)) to vehicles initially filled with LLC (red-colored), if you use SLLC (pink-colored) for the coolant change.

4. HV Battery

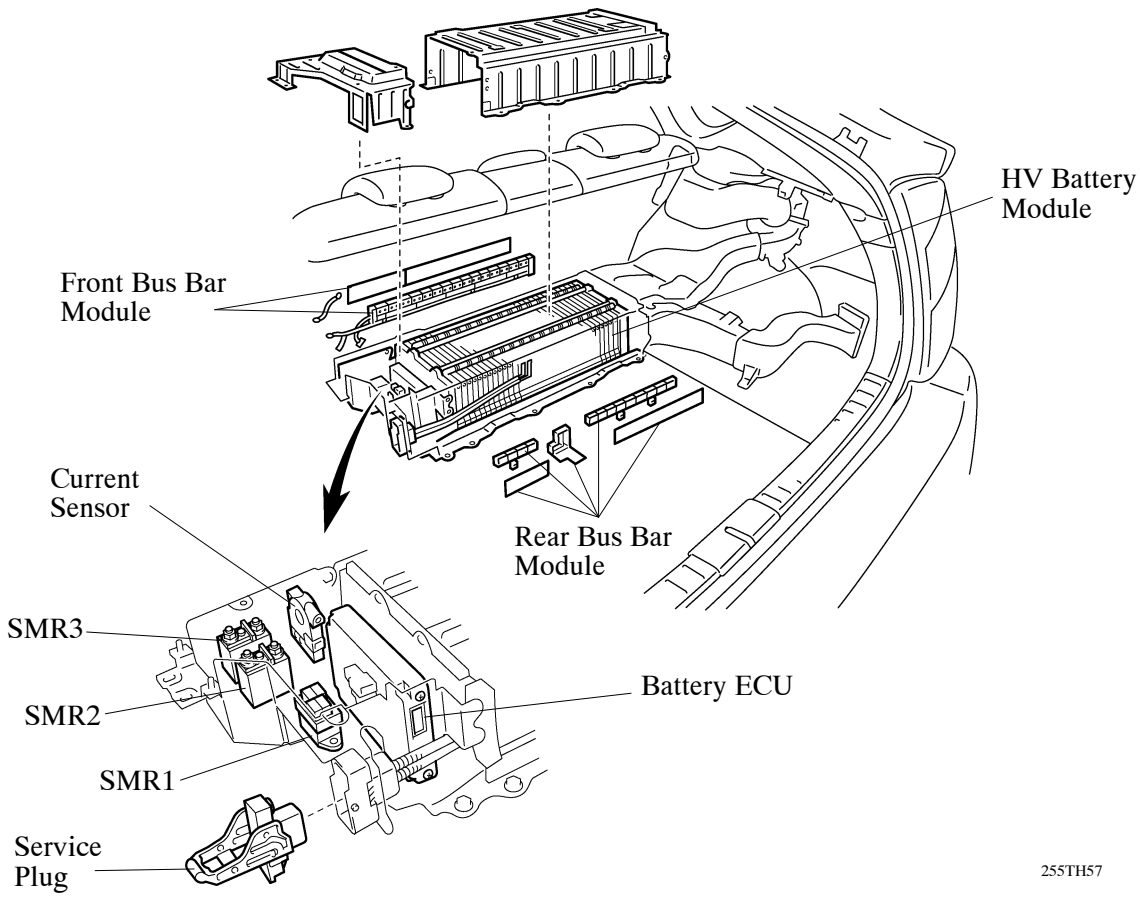
General

- As on the ’03 Prius, the ’04 Prius has adopted sealed nickel hydride (Ni-MH) batteries for the HV battery. This HV battery has a high power density, it is lightweight, and it offers longevity to match the characteristics of the THS-II system. Because the THS-II system effects charge/discharge control to maintain the HV battery at a constant level of SOC (state of charge) while the vehicle is operating normally, it does not rely on the use of external recharges.
- The HV battery, battery ECU, and SMR (System Main Relay) enclosed in a signal case and placed in the luggage compartment behind the rear seat to make more effective use of vehicle space.
- A service plug that shuts off the circuit is provided in the middle of the 28 modules (Between No.19 module and No.20 module). Before servicing any portion of the high-voltage circuit, make sure to remove the service plug.
- To ensure the HV battery’s performance considering the heat that is generated in the HV battery during charging and discharging, the battery ECU controls the operation of the cooling fan.

— Main Changes from ’03 Prius —

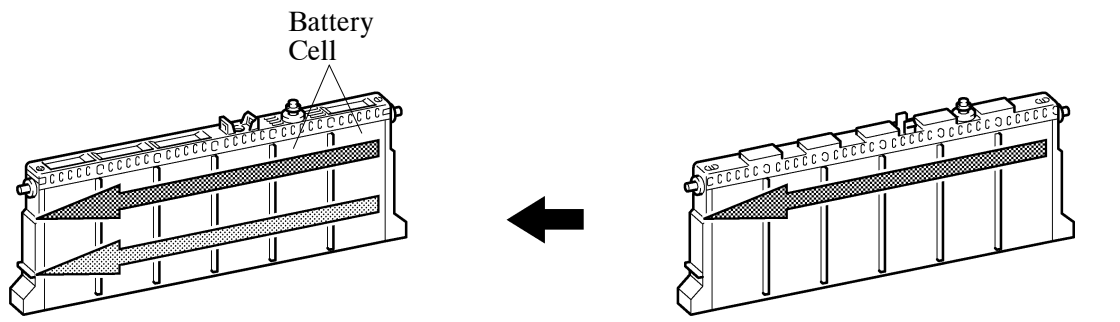
- The HV battery of the ’03 Prius consists of 228 cells ({1.2V x 6 cells} x 38 modules) with a nominal voltage of DC 273.6 V. In contrast, the HV battery of the ’04 Prius consists of 168 cells ({1.2V x 6 cells} x 28 modules) with a nominal voltage of 201.6V. A compact and lightweight battery configuration has been achieved through these internal improvements.
- On the ’03 Prius, the connection between the cells of the HV battery consists of one spot. In contrast, the cells on the ’04 Prius are connected with two spots. The internal resistance of the battery has been reduced by this improvement.

Layout of Main Components



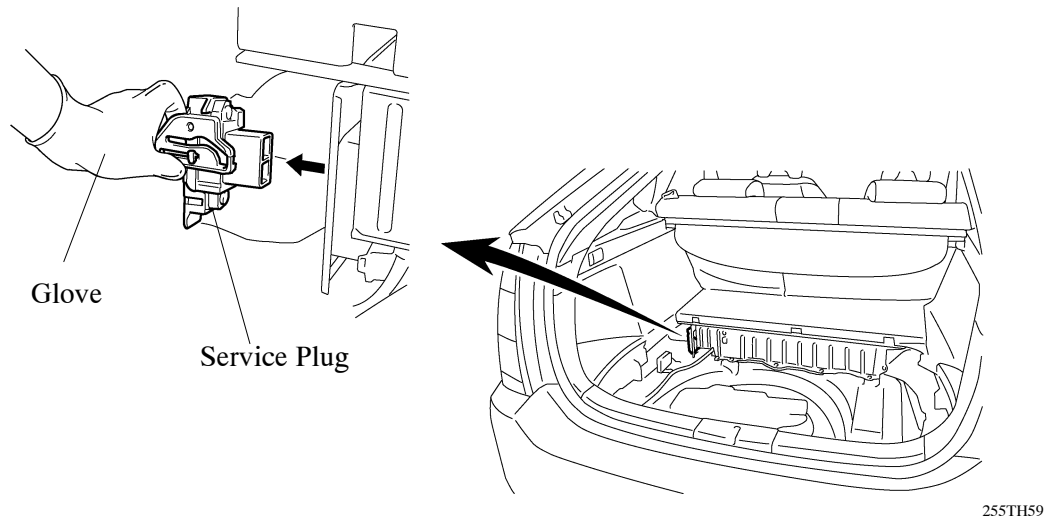
HV Battery Module

On the ’03 Prius, the connection between the cells of the HV battery consists of one spot at the upper part of the cells. In contrast, the cells on the ’04 Prius are connected with two spots, with an additional connection at the lower part of the cells. The internal resistance of the battery has been reduced by this improvement.



Service Plug

By removing the service plug before performing any inspection or service, the high-voltage circuit is shut off at the intermediate position of the HV battery, thus ensuring safety during service.
The service plug assembly contains a lead switch for interlock. Lifting the clip lock up turns OFF the lead switch, which shuts off the SMR. However, to ensure safety, make sure to turn OFF the ignition switch before removing the service plug.
The main fuse for the high-voltage circuit is provided inside of the service plug assembly.
For further details on how to handle the service plug and other safety cautions, refer to the ’04 Prius Repair Manual (Pub. No. RM1075U).

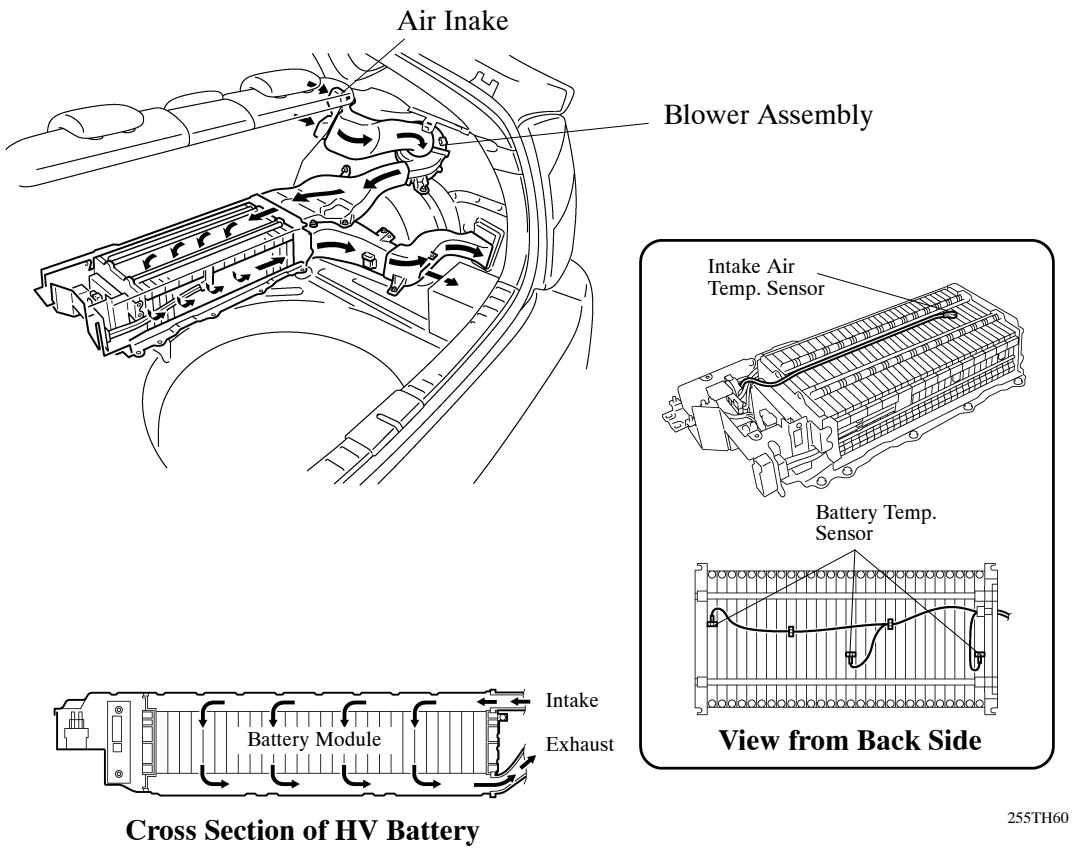


Service Tip

After the service, please do not start the system until the service plug is connected. The battery ECU may break down.

HV Battery Cooling System

- To ensure the proper performance of the HV battery while it generates heat during the repetitive charge and discharge cycles, a dedicated cooling system for the HV battery has been adopted.
- A cooling fan is provided on the right side of the luggage compartment, in order to draw the cabin air by way of the air intake located at the right side of the rear seat. Thereafter, the intake air that has entered from the top right area of the battery flows between the battery modules from the top to the bottom to cool the battery modules. Then, the air flows through the exhaust duct and the cabin, in order to be discharged outside of the vehicle.
- The battery ECU controls the operation of the cooling fan. The battery ECU controls the temperature of the HV battery to an appropriate level in accordance with the signals provided by the three battery temperature sensors that are built into the HV battery, and one intake air temperature sensor. For details, refer to the Battery ECU Control on page TH-53.



View from Back Side

Cross Section of HV Battery

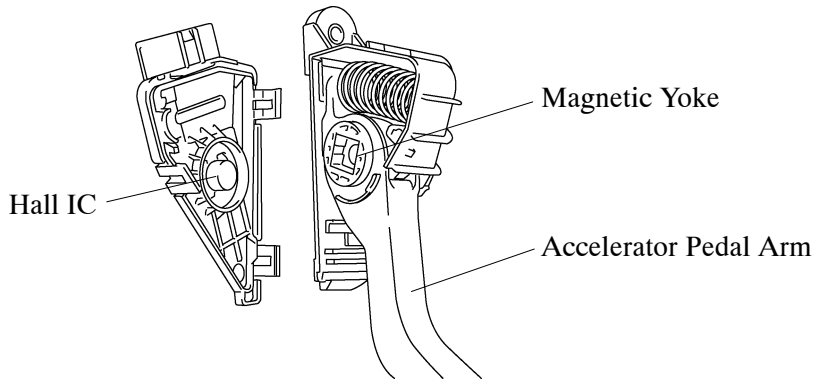
255TH60

▶ Specifications ◀

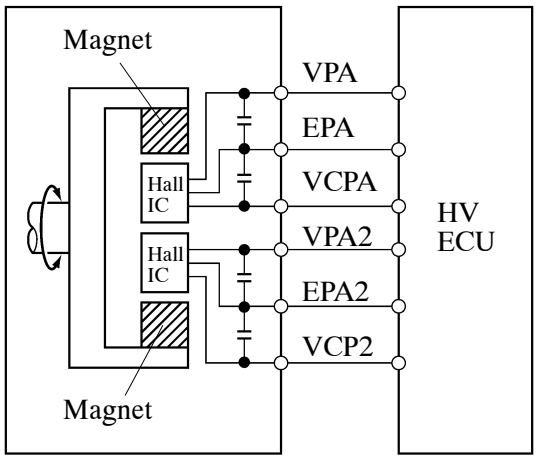
Model		’04 Prius		’03 Prius	
Type		Sirocco Fan		←	
Fan Size Dia. × H	mm (in.)	100 × 50 (4.0 × 2.0)		100 × 40 (4.0 × 1.6)	
Motor Type		DC Motor		←	
Air Flow Volume	m^3/h	Step-less Control		3-step Control	
		Min.	40	Lo	50
				Mid	100
		Max.	150	Hi	150
Power Consumption	W	50 or less		60	

5. Accelerator Pedal Position Sensor

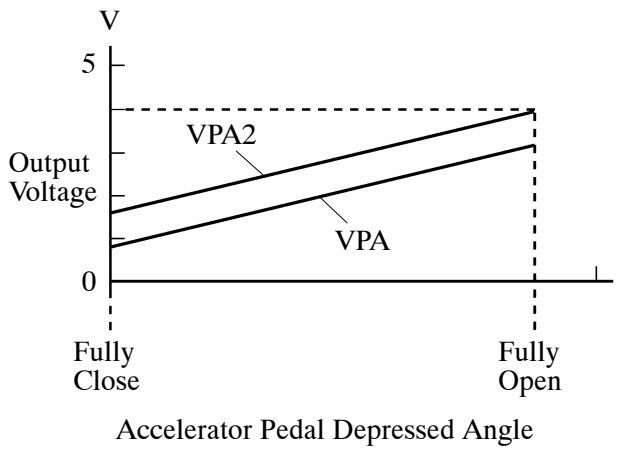
The magnetic yoke that is mounted at the base of the accelerator pedal arm rotates around the Hall IC in accordance with the amount of effort that is applied to the accelerator pedal. The Hall IC converts the changes in the magnetic flux that occur at that time into electrical signals, and outputs them in the form of accelerator pedal effort to the HV ECU.



228TU23



228TU24



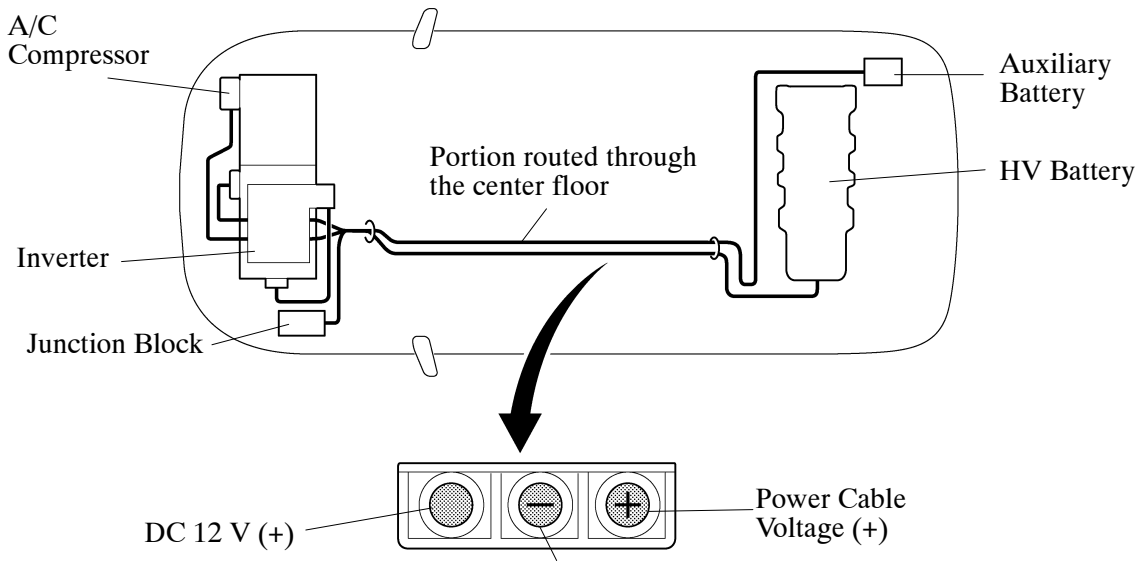
228TU25

Service Tip

The inspection method differs from the conventional accelerator pedal position sensor because this sensor uses a hall IC. For details, refer to the 2004 Prius Repair Manual (Pub. No. RM1075U.)

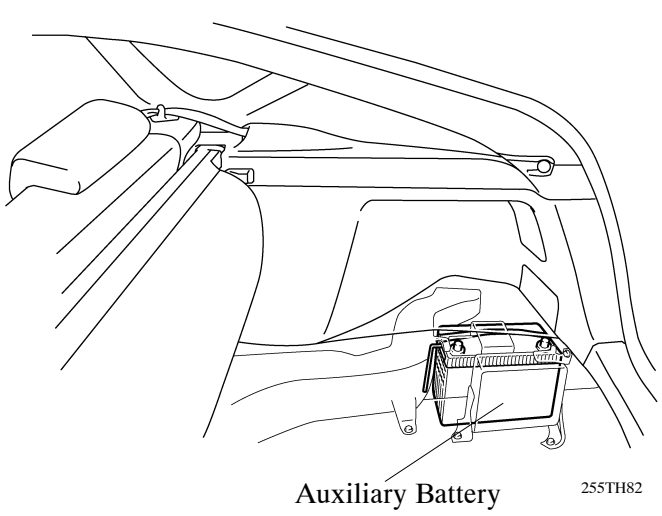
6. Power Cable

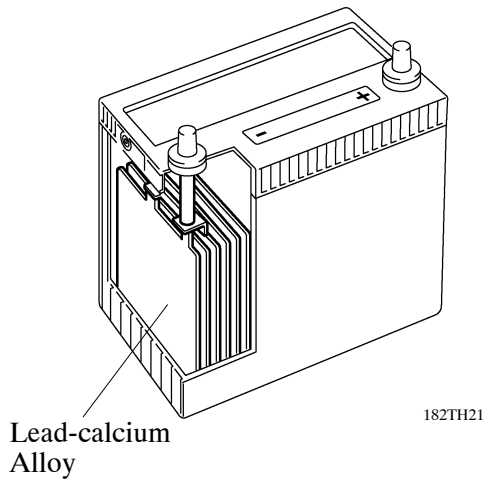
The power cable is a high-voltage, high-amperage cable that connects the HV battery with the inverter, the inverter with MG1 and MG2, and inverter with A/C compressor. Starting from the connector at the left front of the HV battery located in the luggage compartment, the power cable is routed under the rear seat, through the floor panel, along the under-the-floor reinforcement, and connects to the inverter in the engine compartment. A shielded cable is used for the power cable in order to reduce electromagnetic interference. The DC 12 V (+) wiring of the auxiliary battery also follows the same route.
For identification purposes, the high-voltage wiring harness and connectors are color-coded orange to distinguish them from those of the ordinary low-voltage wiring.



7. Auxiliary Battery

The ’04 Prius uses a shielded, maintenance-free DC 12 V battery as the auxiliary battery. Depending on a destination or equipment items, either of the battery types, S34B20R or S46B24R, will be equipped.





Service Tip

Battery fluid is filtered into separators in order to reduce hydrogen gas released which occurs when the battery is charged.
Therefore, battery fluid does not need to be replaced, as long as the specified battery is used.

■THS-II CONTROL SYSTEM

1. General

The THS-II control system contains the following components.

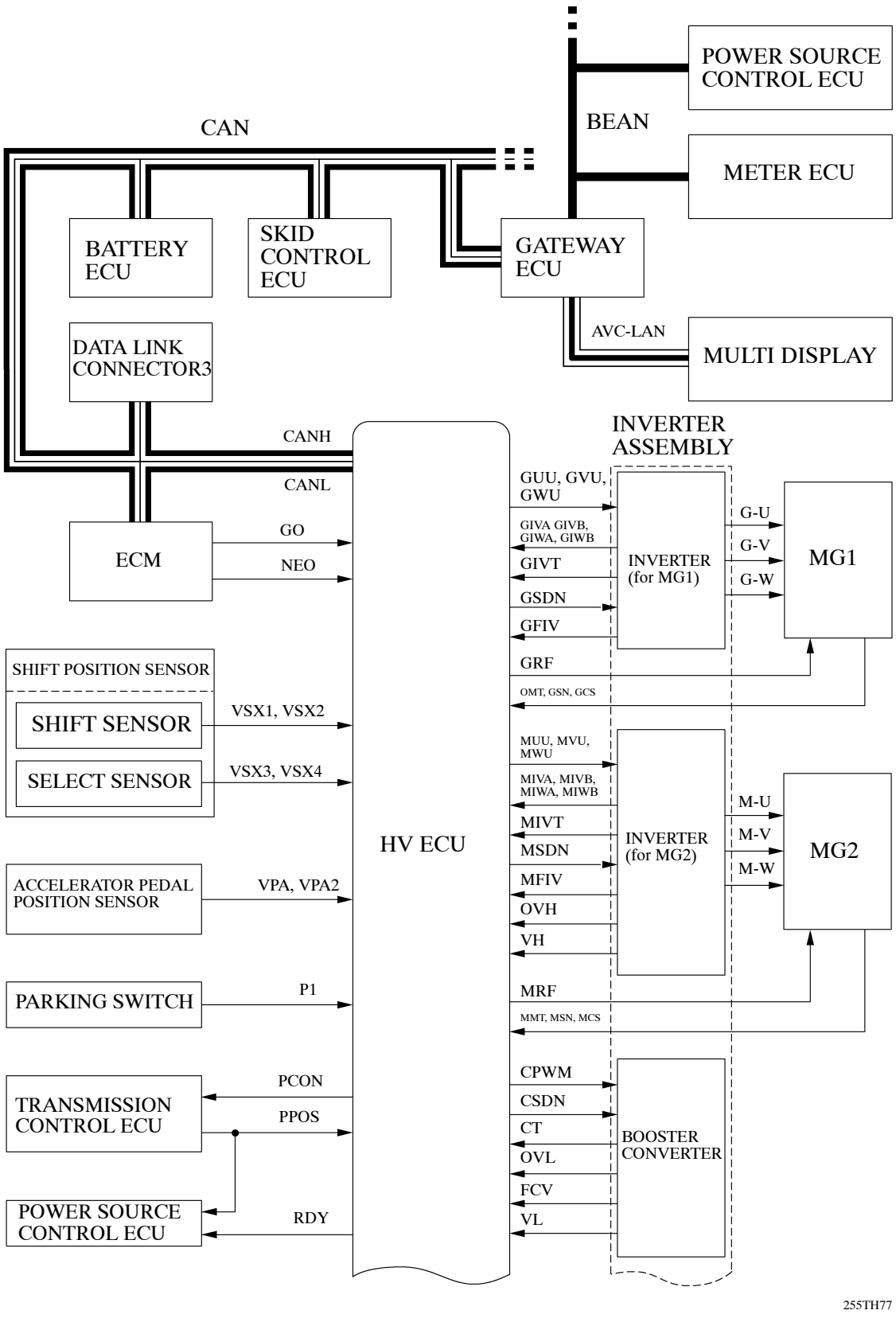
Item	Outline
HV ECU Control (See page TH-44)	• Control the MG1, MG2 and the engine according to the demand torque, regenerative brake control and the SOC (State of Condition) of HV battery. These factors are determined by the shift position, the degree which the accelerator pedal is depressed and vehicle speed. • The HV ECU monitors the SOC of the HV battery and the temperature of the HV battery, MG1, and MG2, in order to optimally control these items. • When the shift position is in the “N” position, the HV ECU effects shut down control to electrically stop MG1 and MG2. • The uphill assist control prevents the vehicle from sliding downward when the brake is released during startup on a steep slope. • If the drive wheels rotate without traction, the HV ECU performs the motor traction control that provides a restraint on a rotation of MG2, in order to protect the planetary gear unit and prevent MG1 from generating excessive electricity. • For the purpose of protecting the circuit from high voltage and ensuring the reliability of the circuit shut down, the HV ECU effects SMR control through the use of 3 relays to connect and shut down the high-voltage circuit.
ECM Control (See page TH-50)	The ECM receives the target engine speed and required engine motive force, which were sent from HV ECU, and controls the ETCS-i system, fuel injection volume, ignition timing and VVT-i system.
Inverter Control (See page TH-51)	• In accordance with the signals provided by the HV ECU, the inverter converts a direct current from HV battery into an alternating current for MG1 and MG2, or vice versa. In addition, the inverter supplies the alternating current from MG1 power to the alternating current for MG2. • The HV ECU sends the signal to the power transistor in the inverter for switching the U, V and W phase of the MG1 and MG2 in order to drive the MG1 and MG2. • The HV ECU shuts down if it receives an overheating, over-current, or fault voltage signal from the inverter.
Boost Converter Control	• In accordance with the signals provided by the HV ECU, the boost converter boosts the nominal voltage of DC 201.6 V (for HV battery) up to the maximum voltage of DC 500 V. • The maximum voltage of AC 500 V generated by MG1 or MG2 is converted into a direct current by the inverter, the boost converter drops the DC 500 V to DC 201.6 V (for HV battery) based on the signals from the HV ECU.
Converter Control	• Drops the nominal voltage of DC 201.6 V into DC 12 V in order to supply electricity to body electrical components, as well as to recharge the auxiliary battery (DC 12 V). • This converter controls the voltage of the auxiliary battery to a constant voltage.
A/C Inverter Control	Converts the nominal voltage of DC 201.6 V of the HV battery to AC 201.6 V and supplies power to operate the electric inverter compressor of the A/C system.

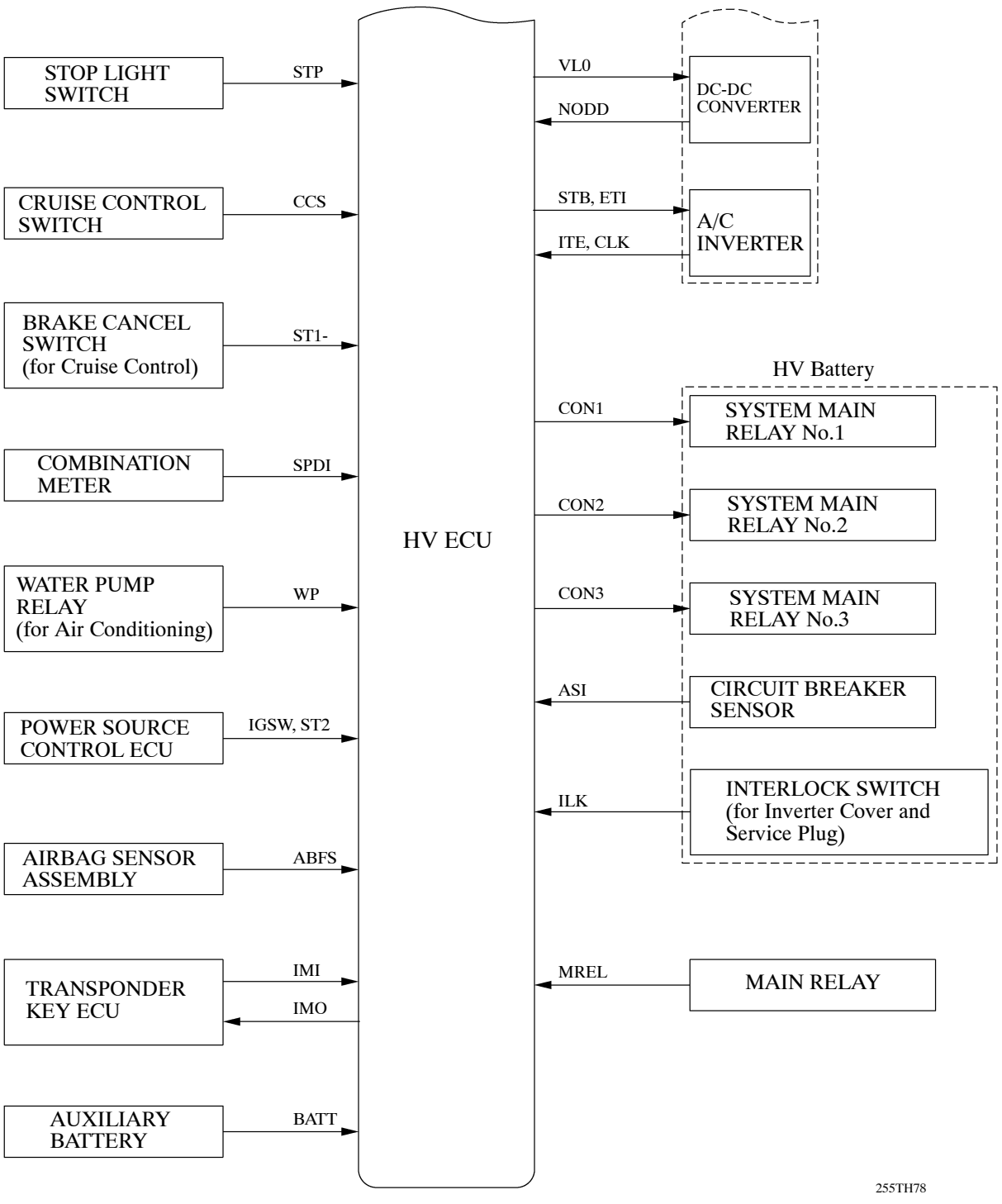
(Continued)

Item	Outline
MG1 and MG2 Main Control	• MG1, which is rotated by the engine, generates high voltage (maximum voltage of AC 500V) in order to operate MG2 and charge the HV battery. Also, it functions as a starter to start the engine. • Driven by electrical power from MG1 or HV battery, and generates motive force for the vehicle. • During braking, or when the accelerator pedal is not depressed, it generates electricity to recharge the HV battery (Regenerative brake control). • Speed sensors (resolver) detect the speed and position of MG1 and MG2 and output them to the HV ECU. • A temperature sensor mounted on MG2 detects the temperature and transmits it to the HV ECU
Skid Control ECU Control (See page TH-52)	During braking, the skid control ECU calculates the required regenerative brake force and transmits it to the HV ECU. Upon receiving this signal, the HV ECU transmits actual regenerative brake control value to the skid control ECU. Based on this result, the skid control ECU calculates and executes the required hydraulic pressure brake force.
Battery ECU Control (See page TH-53)	The battery ECU effects monitor control to monitor the conditions of the HV battery and cooling fan control to keep the HV battery at a predetermined temperature. Thus, it optimally controls these components.
Shift Control (See page CH-8)	• The HV ECU detects the shift position (“R”, “N”, “D” or “B”) in accordance with the signal provided by the shift position sensor, and controls MG1, MG2, and the engine, in order to create the driving conditions that suit the selected shift position. • The transmission control ECU detects that the driver has pressed the parking switch through a signal provided by the HV ECU. Then, it operates the shift control actuator in order to mechanically lock the transaxle.
During Collision Control (See page TH-56)	During a collision, if the HV ECU receives an airbag deployment signal from the airbag sensor assembly or an actuation signal from the circuit breaker sensor located in the inverter, it turns OFF the SMR (System Main Relay), in order to shut off the entire power supply.
Cruise Control System Operation Control	When the cruise control ECU that is enclosed in the HV ECU receives a cruise control switch signal, it regulates the motive forces of the engine, MG1 and MG2 to be an optimum combination in order to obtain the targeted vehicle speed by a driver’s demand.
Indicator and Warning Light Illumination Control (See page TH-57)	Illuminates or blinks the lights to inform the driver of the vehicle conditions or system malfunctions.
Diagnosis (See page TH-58)	When the HV ECU detects a malfunction, the HV ECU diagnosis and memorizes the values corresponding to the failure.
Fail-Safe (See page TH-58)	When the HV ECU detects malfunction, the HV ECU stops or controls the actuator and ECUs according to the data already stored in memory.

2. Construction

The configuration of the THS-II control system in the ’04 Prius is shown in the following chart.




STOP LIGHT SWITCH
STP
CRUISE CONTROL SWITCH
CCS
BRAKE CANCEL SWITCH (for Cruise Control)
ST1-
COMBINATION METER
SPDI
WATER PUMP RELAY (for Air Conditioning)
WP
POWER SOURCE CONTROL ECU
IGSW, ST2
AIRBAG SENSOR ASSEMBLY
ABFS
TRANSPONDER KEY ECU
IMI
IMO
AUXILIARY BATTERY
BATT
HV ECU
VL0
NODD
DC-DC CONVERTER
STB, ETI
ITE, CLK
A/C INVERTER
HV Battery
CON1
SYSTEM MAIN RELAY No.1
CON2
SYSTEM MAIN RELAY No.2
CON3
SYSTEM MAIN RELAY No.3
ASI
CIRCUIT BREAKER SENSOR
ILK
INTERLOCK SWITCH (for Inverter Cover and Service Plug)
MREL
MAIN RELAY
255TH78

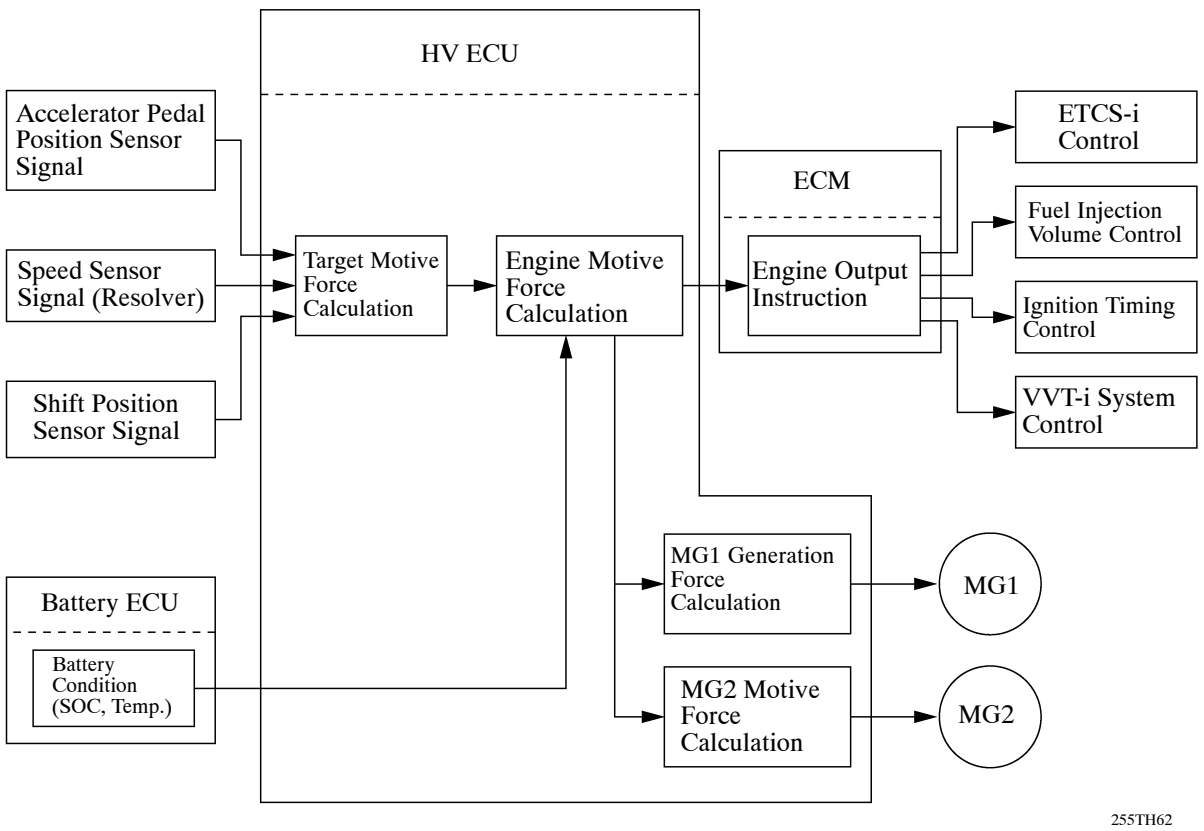
3. HV ECU Control

General

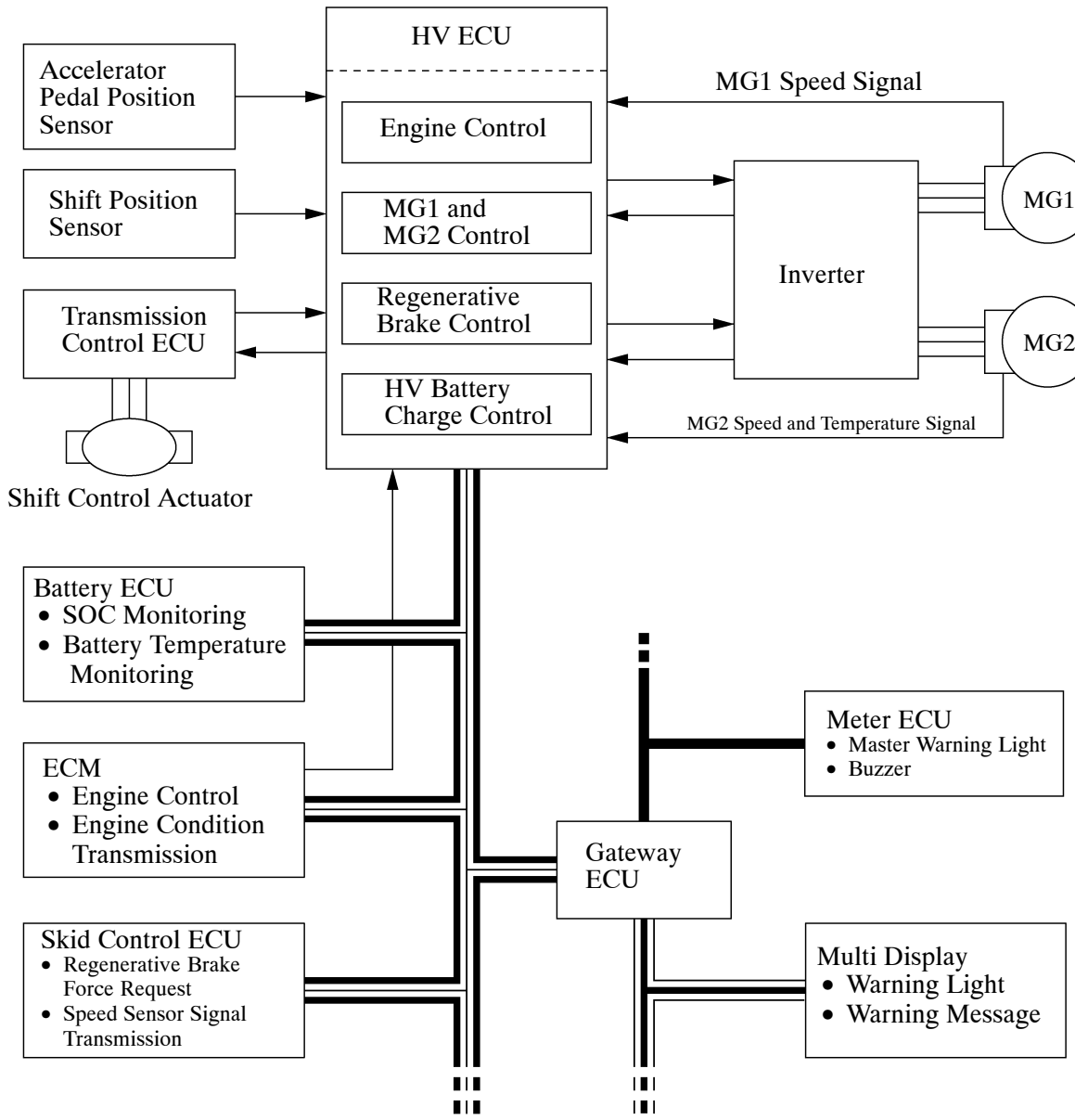
The HV ECU detects the amount of effort applied to the accelerator pedal in accordance with the signals provided by the accelerator pedal position sensor. The HV ECU receives the vehicle speed signals from the speed sensor (resolver) in the MG1 and MG2, and detects the shift position signal from the shift position sensor. The HV ECU determines the driving conditions of the vehicle in accordance with these pieces of information, and optimally controls the motive forces of MG1, MG2, and the engine. Furthermore, the HV ECU optimally controls the output and torque of these motive forces in order to realize lower fuel consumption and cleaner exhaust emissions.

▶ Flow of Motive Force Calculation ◀

(Target Motive Force) − (Engine Motive Force) = (MG2 Motive Force)



▶ System Diagram ◀



: CAN (Controller Area Network)

: BEAN (Body Electronics Area Network)

: AVC-LAN (Audio Visual Communication – Local Area Network)

255TH63

System Monitoring Control

- The battery ECU constantly monitors the SOC (state of charge) of the HV battery, and transmits the SOC to the HV ECU. When the SOC is below the lower level, the HV ECU increases the power output of the engine to operate MG1, which charges the HV battery. When the engine is stopped, MG1 operates to start the engine; then, the engine operates MG1 to charge the HV battery.
- If the SOC is low, or the temperature of the HV battery, MG1, or MG2 is higher than the specified value, the HV ECU restricts the motive force applied to the drive wheels until it is restored to the normal value. A temperature sensor that is built into MG2 directly detects the temperature of MG2. The HV ECU calculates the temperature of MG1.

Shut Down Control

Generally, MG1 and MG2 are shut down when the shift position is in the “N” position. This is because MG1 and MG2 must be stopped electrically as a means of shutting down the motive force, since MG2 is mechanically joined to the front wheels.
However, the shut down function is canceled under the following exceptions:

- During driving, if the brake pedal is depressed and a wheel lock up, the ABS with EBD is activated. After this, low torque is requested from the MG2 to provide supplemental power in order to restart the rotation of the wheel. Even if the shift position is in the “N” position at this time, the shut down function is canceled to allow the wheel to rotate. After the wheel rotation has been restarted, the system resumes its shut down function.

- When the vehicle is driven in the “D” or “B” position and the brake pedal is depressed, the regenerative brake operates. At this time, as the driver moves the shift position to the “N” position, the brake hydraulic pressure increases while the request torque of the regenerative brake decreases gradually so as not to create a sluggish brake feel. After this, the system effects the shut down function.

- When MG1 and MG2 operate at higher speed than the specified level, the shut down function is canceled.

Uphill Assist Control

- This control prevents the vehicle from sliding downward when the brake is released during startup on a steep slope. Because the motor has a highly sensitive speed sensor, it responsively senses the angle of the slope and vehicle’s decent and ensures safety by increasing the motor’s torque.

- If the uphill assist control is applied, the brakes might be applied to the rear wheels to prevent the vehicle from receding backwards. At this time, the HV ECU transmits a rear brake actuation signal to the skid control ECU.

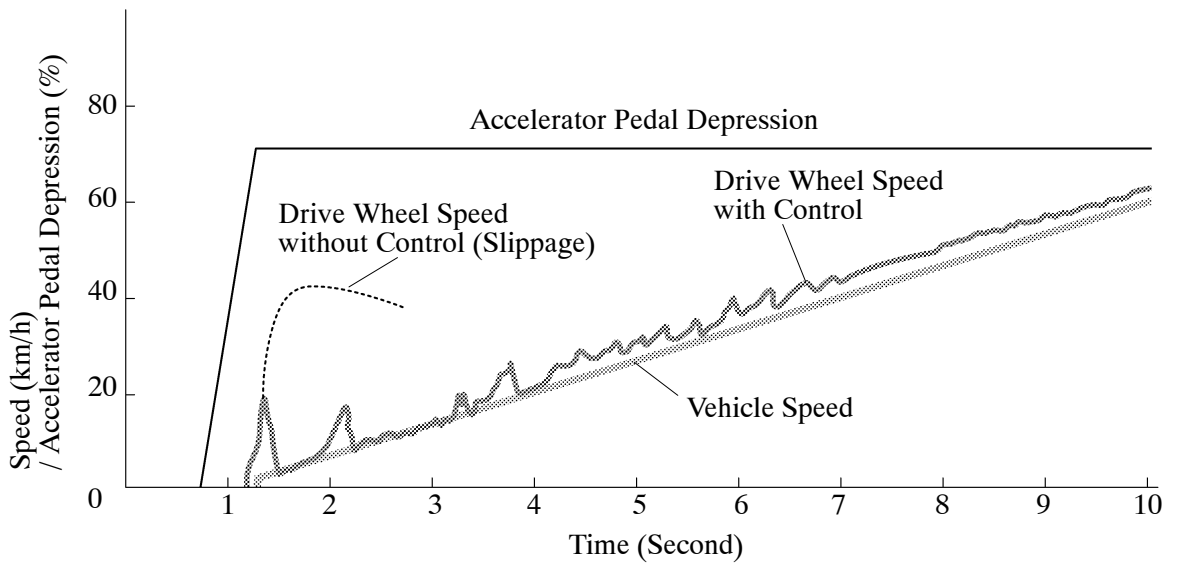
Motor Traction Control

1) General

- If a drive wheels slips while the vehicle is being driven on a slippery road surface, MG2 (which is coupled directly to the wheels) will spin excessively, causing the relative rotational speed of the planetary gear unit to increase. This condition could damage the areas that support the parts in the planetary gear unit, such as through seizure. In some cases, this condition could cause MG1 to generate an excessive amount of electricity. For this reason, if the HV ECU determines that MG2 is spinning excessively upon monitoring a sudden change in rotational speeds by way of speed sensor signals, the HV ECU applies a brake force to suppress the rotation, in order to protect the planetary gear unit.
- Furthermore, if only one of the drive wheels spins excessively, the HV ECU will monitor the speed difference between the right and left wheel by way of the speed sensors of the respective wheels, and the HV ECU will transmit a command to the skid control ECU in order to apply a brake to the wheel that is spinning excessively.

These controls achieve the same effect as the TRAC of the brake control system.

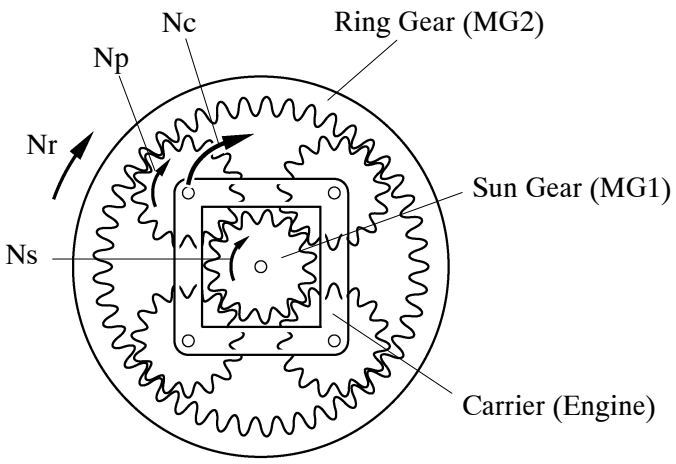
▶ Drive wheel speed behavior at Start-up a snowy road ◀



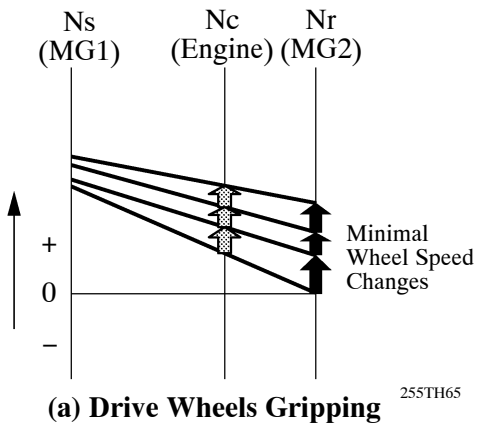
255TH89

2) Operation

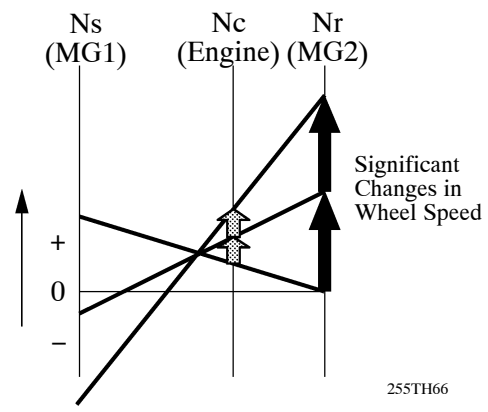
- The following describes the mechanism that generates the excessive rotation. For example, if the drive wheels have a normal grip, the changes in the rotational speed of MG2 (drive wheels) are minimal, as shown in Figure (a). Thus, the proper balance is maintained between them and the engine with minimal changes in speed, resulting in minimal differences in the relative rotational speeds of the planetary gear unit as a whole.
- If the drive wheels are in the state of loss of traction, a rotation speed of MG2 (drive wheels) varies largely as shown in Figure (b). As a result, difference of the relative rotation speeds in the whole planetary gear unit becomes larger, because the engine that has a small rotating variation cannot follow the rotation of MG2.



Planetary Gear Unit Schematic Diagram

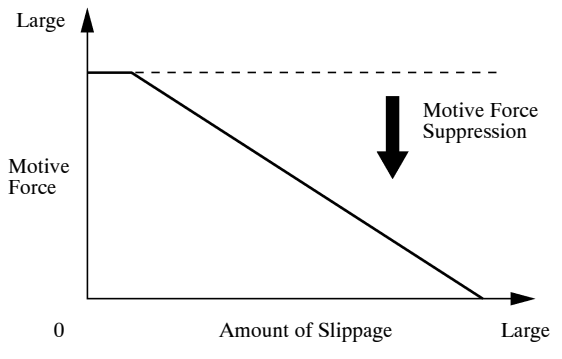


(a) Drive Wheels Gripping



(b) Drive Wheels Slipping

- The HV ECU monitors sudden changes in speed through the speed sensor signals provided by MG2, in order to calculate the amount of slippage of the drive wheels. The HV ECU controls the motive force by suppressing the rotation of MG2 in accordance with the calculated amount of slippage.



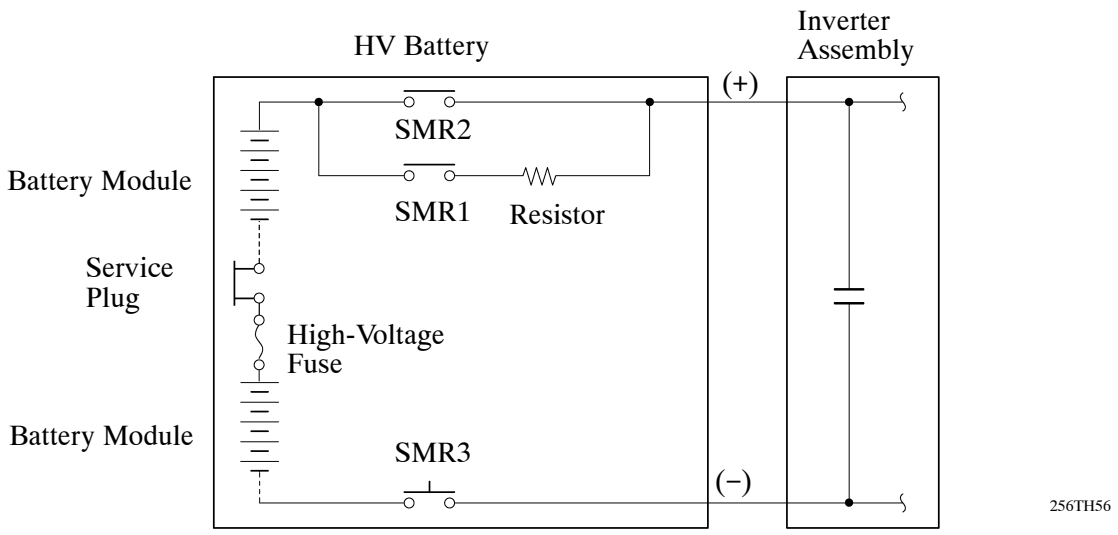
Conceptual Image of Motor Traction Control

SMR (System Main Relay) Control

1) General

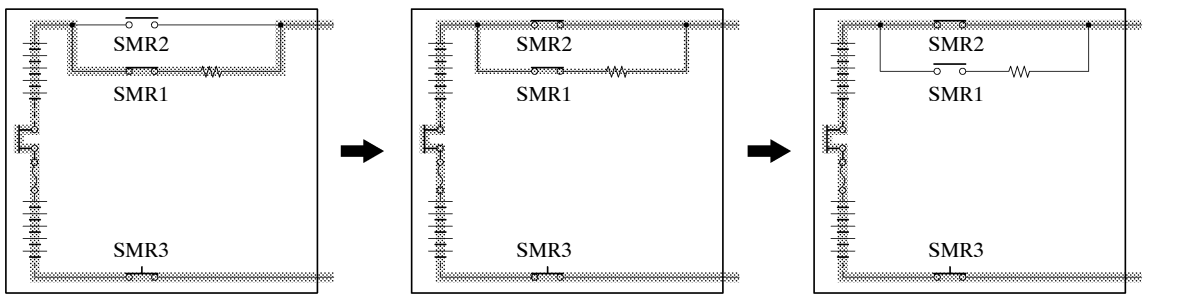
The SMR is a relay that connects and disconnects the power source of the high-voltage circuit upon receiving a command from the HV ECU. A total of 3 relays, one for the negative side, and two for the positive side, are provided to ensure proper operations.

▶ System Diagram ◀



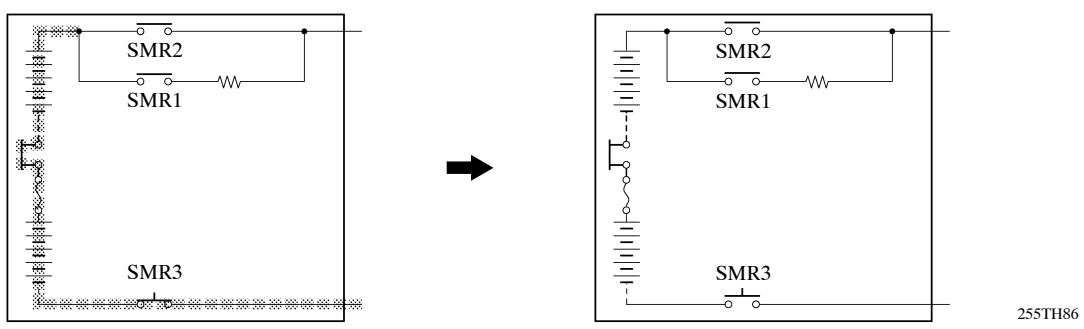
2) Power is ON

SMR1 and SMR3 turn ON when the circuit is connected; subsequently, SMR2 turns ON and SMR1 turns OFF. As the controlled current is initially allowed to pass through a resistor in this manner, the contact point in the circuit is protected from damage that could be caused by a rush current.



3) Power is OFF

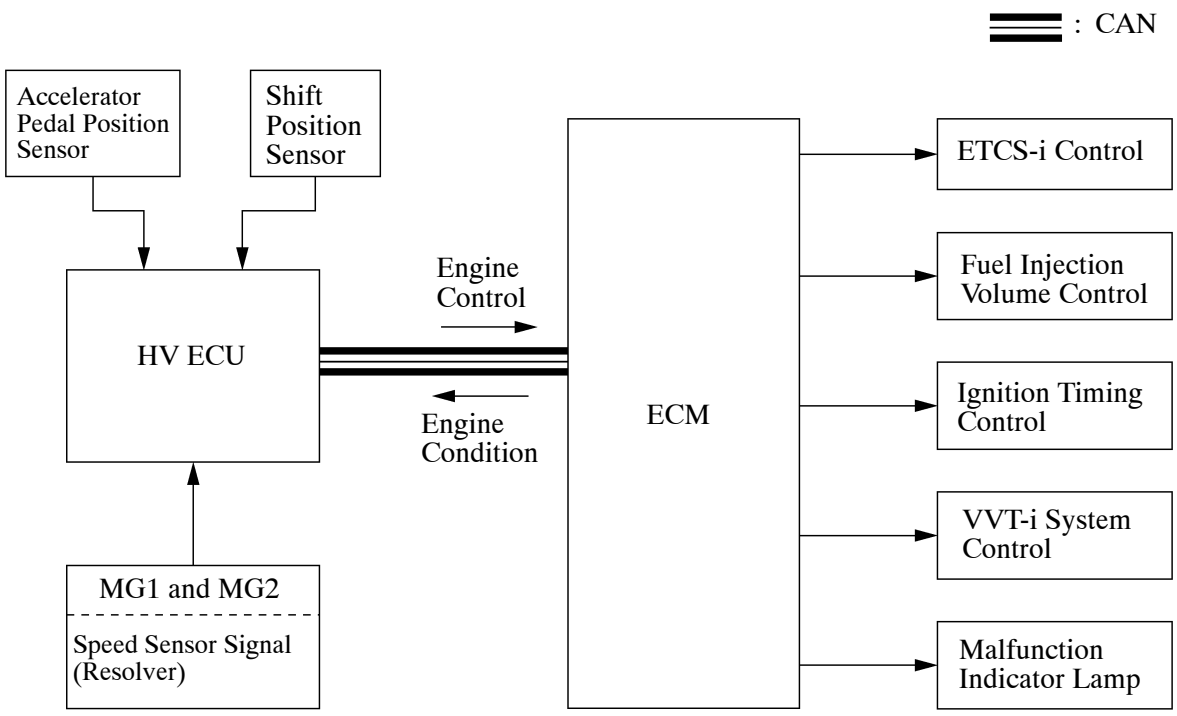
SMR2 and SMR3 turn OFF when the circuit is disconnected, in that order. Then, the HV ECU verifies that the respective relays have been properly turned off. Accordingly, the HV ECU is able to determine if SMR2 is stuck.



4. ECM Control

- The ECM receives the target engine speed and required engine motive force, which were sent from HV ECU, and controls the ETCS−i system, fuel injection volume, ignition timing and VVT−i system.
- The ECM transmits the operating condition of the engine to the HV ECU.
- Upon receiving an engine stop signal from the HV ECU in accordance with the basic THS-II control, the ECM will stop the engine.
- When a malfunction occurs in the system, the ECM activates MIL via the directions from the HV ECU.

▶ System Diagram ◀

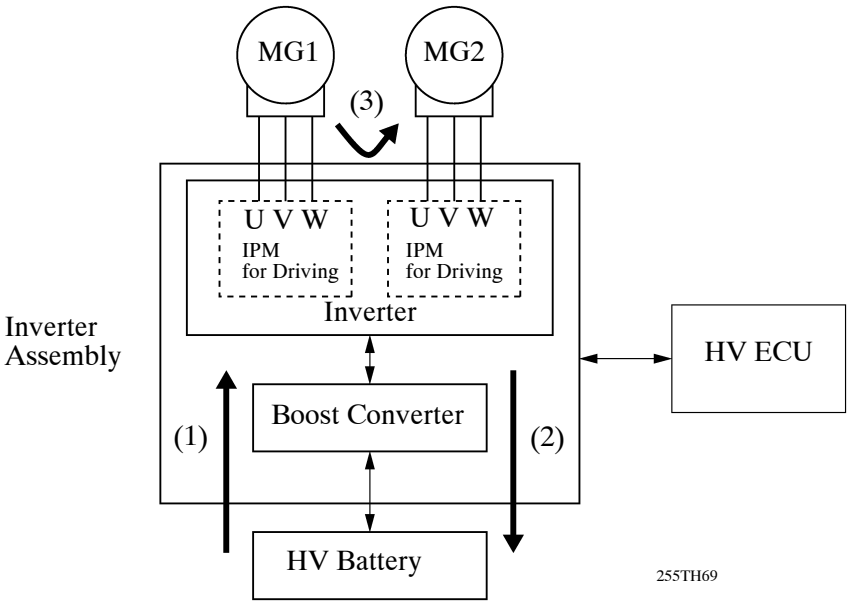


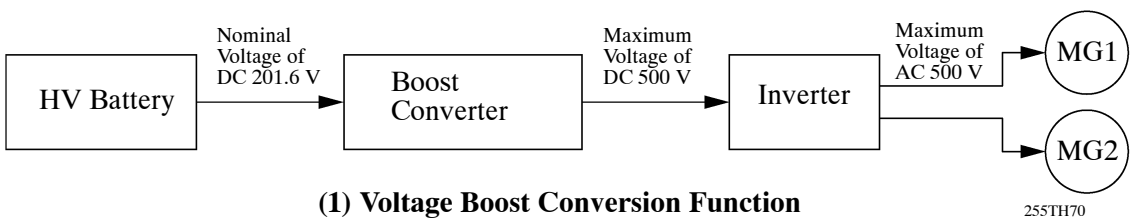
255TH68

5. Inverter Control

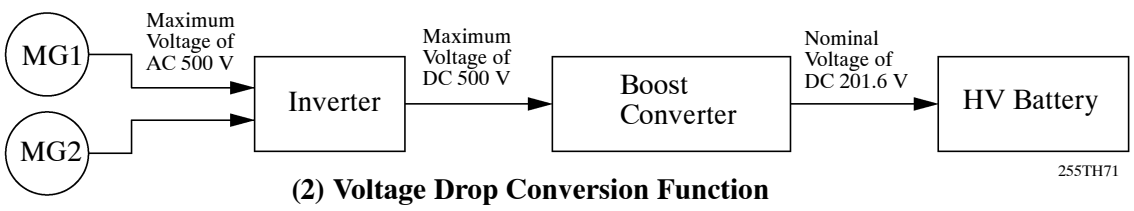
- In accordance with the signals provided by the HV ECU, the inverter converts a direct current from HV battery into an alternating current for MG1 and MG2, or vice versa. In addition, the inverter supplies the alternating current from MG1 power to the alternating current for MG2. However, when electricity is supplied from MG1 to MG2, the electricity is converted into DC inside the inverter.
- The HV ECU transmits a signal to the power transistor in the inverter for switching the U, V and W phase of the stator coil of MG1 and MG2, based on the rotor position information sent from MG1 and MG2 and the SOC of the HV battery sent from the battery ECU. When shutting down the current to MG1 and MG2 a signal is sent to the inverter from the HV ECU.

▶ System Diagram ◀

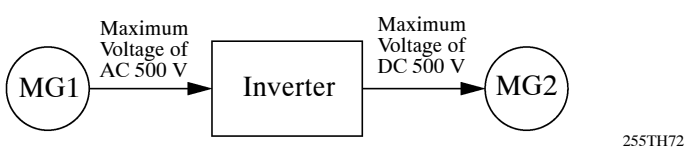




(1) Voltage Boost Conversion Function



(2) Voltage Drop Conversion Function

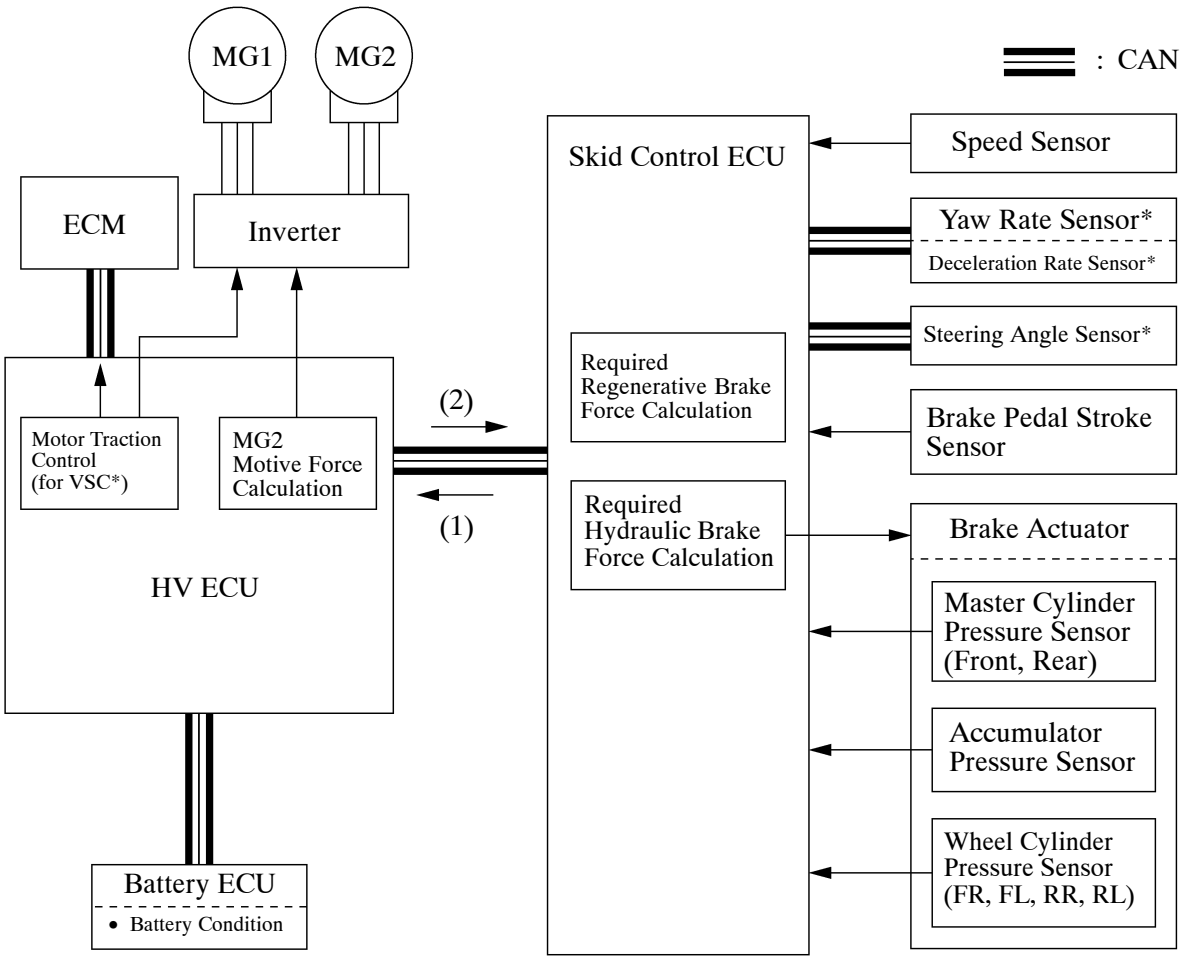


(3) Electrical Power Supply Function

6. Skid Control ECU Control

- The skid control ECU calculates the total braking force needed, based on the master cylinder pressure in the brake actuator and brake pedal stroke sensor generated when the driver depresses the brake pedal.
- The skid control ECU computes a part for the required regeneration brake force from the total braking force, and sends the result to the HV ECU.
- The HV ECU executes to the minus torque to MG2, and carries out the regenerative brake functions. The skid control ECU controls the brake actuator solenoid valves and generates the wheel cylinder pressure, which is the actual regenerative brake control value subtracted from the total braking force.
- On a model with Enhanced VSC system, the skid control ECU outputs a request to the HV ECU to effect motor traction control while the vehicle is operating under Enhanced VSC system control. The HV ECU controls the engine, MG1, and MG2 in accordance with the present driving conditions in order to suppress the motive force.

▶ System Diagram ◀



(1): • Regenerative Brake Force Request
• Motor Traction Control Request (for Enhanced VSC System)
(2): • Actual Regenerative Brake Control Value
• Hydraulic Brake Control Request (for Uphill Assist Control)

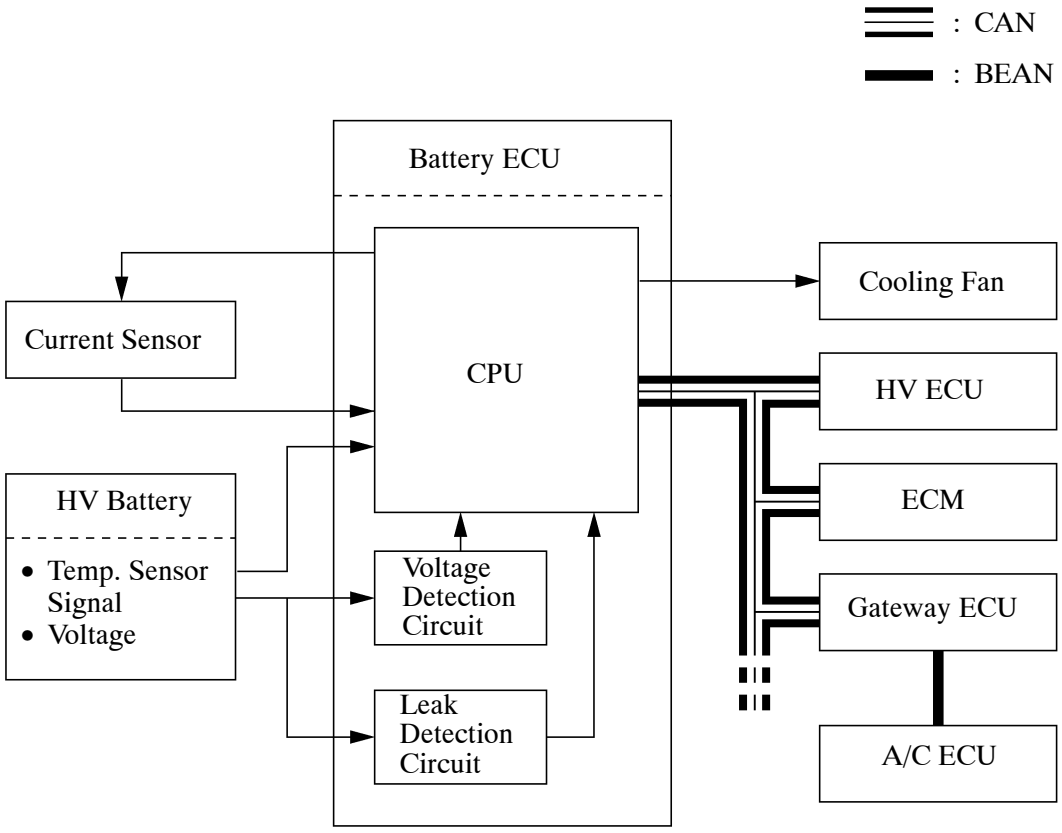
* : Only on model with Enhanced VSC System

7. Battery ECU Control

General

- The battery ECU detects the SOC (state of charge), temperature, leak, and the voltage of the HV battery, and sends this information to the HV ECU.
- The battery ECU detects the temperature of the battery via the temperature sensor located in the HV battery, and operates a cooling fan to control the temperature.

▶ System Diagram ◀



255TH74

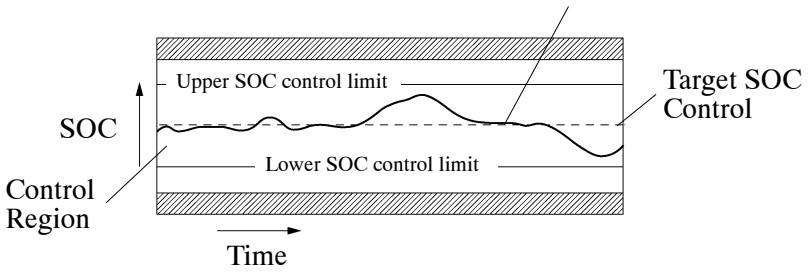
HV Battery Condition Monitoring Control

1) General

- The battery ECU constantly monitors the items listed below and transmits their information to the HV ECU.
  - Detects the HV battery temperature via the temperature sensor in the HV battery.
  - Detects the leak in the HV battery via the leak detection circuit in the HV battery.
  - Detects the voltage of the HV battery via the voltage detection circuit in the HV battery.
  - Detects the amperage via the current sensor.
- The HV battery calculates the SOC by estimating the charging and discharging amperage.

2) SOC Control

While the vehicle is in motion, the HV battery undergoes repetitive charging / discharging cycles, as it becomes discharged by the MG2 during acceleration and charged by the regenerative brake during deceleration. The battery ECU calculates the SOC based on charging/discharging levels detected by the current sensor, and transmits the calculated SOC value to the HV ECU. The HV ECU performs the charging/discharging control based on the received value in order to steady the SOC at its target level anytime.

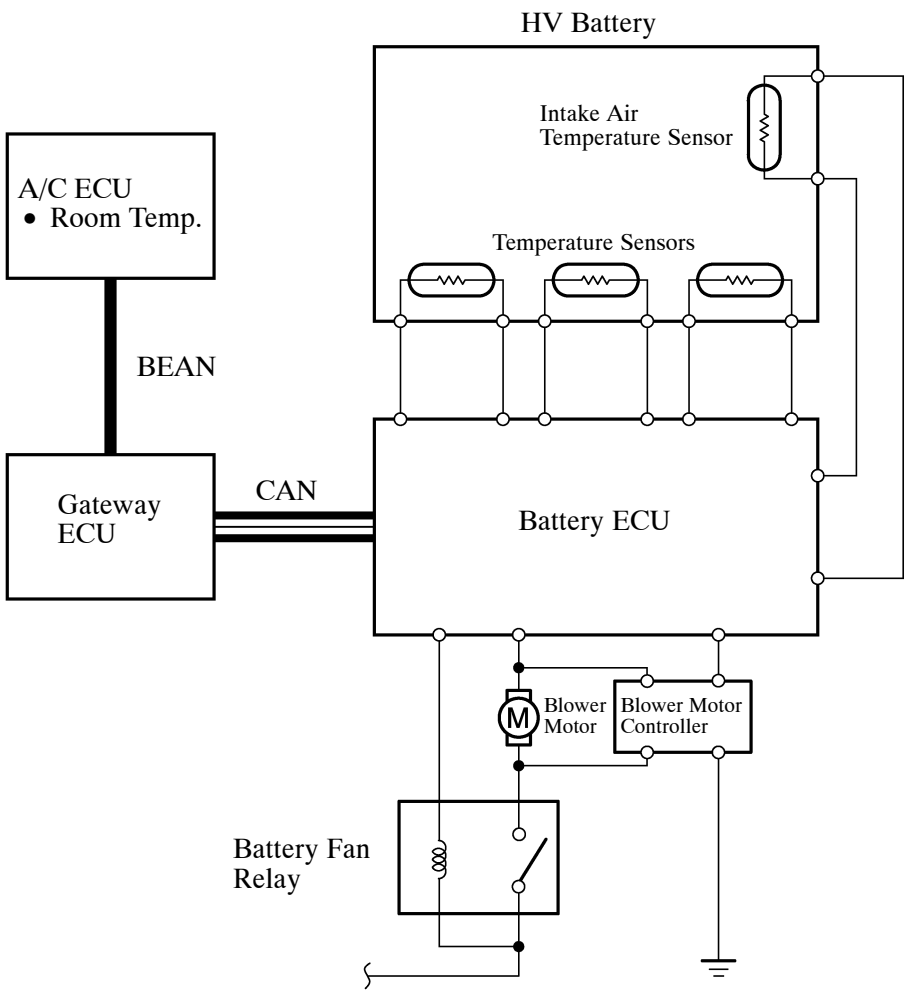


182TH12

Cooling Fan Control

- The battery ECU detects the rise in the battery temperature via the three temperature sensors in the HV battery and one intake air temperature sensor. Then, the battery ECU steplessly actuates the cooling fan under duty cycle control, in order to maintain the temperature of the HV battery within the specified range.
- While the air conditioning system is operating and cooling down the cabin, and if there is any leeway in the HV battery temperature, the battery ECU turns the cooling fan OFF or fixes it to the LO speed. The purpose of this control is to give priority to cooling down the cabin, because the air intake of the cooling system is provided in the cabin.

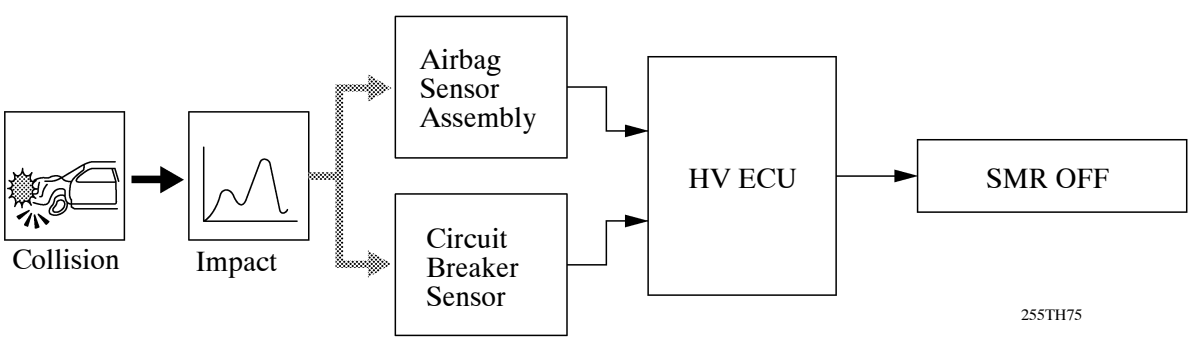
▶ System Diagram ◀



8. During Collision Control

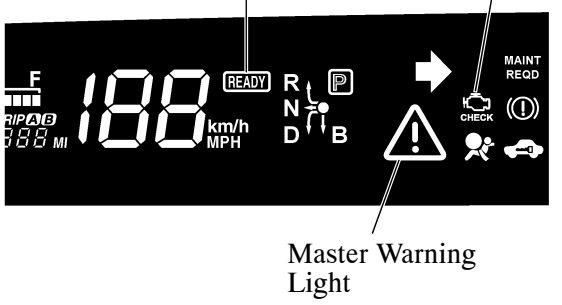
If the HV ECU receives an airbag deployment signal from the airbag sensor assembly or an actuation signal from the circuit breaker sensor located in the inverter during a collision, the HV ECU will shut down the entire power supply by turning the SMR (System Main Relay), in order to ensure safety.

▶ System Diagram ◀



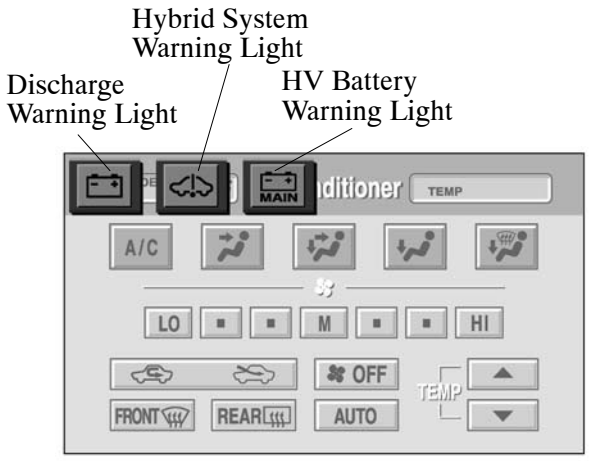
9. Indicator and Warning Light

- The warning lights of the ’04 Prius are different from those on the previous model. In particular, the indicator and warning lights associated with the THS-II system are described below.



Combination Meter

255TH64

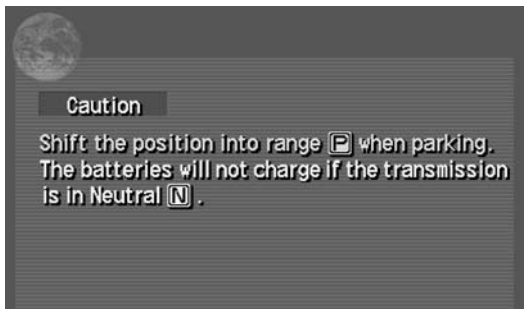


Multi Display

255TH76

Item	Outline
READY Light	This light blinks when the driver simultaneously presses the brake pedal and the push start switch while the shift position is in the “P” position. Thereafter, the light changes to illumination when the system starts. Thus, it informs the driver whether the vehicle is drivable.
Master Warning Light	• The primary function of this warning light, which illuminates simultaneously with the sounding of a warning buzzer, is to inform the driver in case of a malfunction in the THS-II system or when the SOC of the HV battery is lower than the standard. • Besides the foregoing conditions, this light illuminates and the buzzer sounds to inform the driver in case of an abnormal engine coolant temperature, abnormal oil pressure, a malfunction in the EPS system, or a malfunction in the transmission control ECU.
Malfunction Indicator Lamp	Turns on when there is a malfunction in the engine control system.
Discharge Warning Light	Turns on when there is a malfunction in the DC 12 V charging system (converter assembly). At the same time, the master warning light will illuminate.
HV Battery Warning Light	This warning light illuminates to inform the driver that the SOC is lower than the minimum standard value (%). At the same time, the master warning light will illuminate.
Hybrid System Warning Light	This indicator light illuminates to inform the driver of a malfunction in the THS-II system. At the same time, the master warning light will illuminate.

- When any of the conditions described below is present, the message prompt as shown appears in the multi display, accompanied by the illumination of the master warning light and the continuous sounding of the buzzer.
  - ♦ The READY light is illuminated, the shift position is in the “N” position, and the HV battery is discharged.
  - ♦ The READY light is illuminated, the shift position is in the “N”, “B” or ”D” position, and the driver’s door is open.



255TH95

10. Diagnosis

- In the THS-II system, if the HV ECU, ECM, or the battery ECU detects a malfunction, the ECU performs a diagnosis and memorizes failed sections. Furthermore, to inform the driver of the malfunction, the ECU illuminates or blinks the MIL (Malfunction Indicator Lamp), master warning light, or HV battery warning light, which pertains to the ECU.
- The HV ECU, ECM, and the battery ECU will restore the respective DTCs of the malfunctions.
- Three-digit information codes have been provided in the conventional DTC as subset of a primary five-digit code. This enables the troubleshooting procedure to further narrow down a trouble area to identify a problem.
- The DTCs can be accessed through the use of the hand-held tester with CAN extension module.
- All the DTCs have been made to correspond to the SAE controlled codes. Some of the DTCs have been further divided into smaller detection areas than in the past, and new DTCs have been assigned to them. Additionally, DTCs have been added to correspond to items, which had been newly adopted.

For details, refer to the 2004 Prius Repair Manual (Pub. No. RM1075U).

11. Fail-Safe

If the HV ECU detects a malfunction in the THS-II system, it will control the system in accordance with the data that is stored in its memory.
For details, refer to the 2004 Prius Repair Manual (Pub. No. RM1075U).

PE11-005

TOYOTA

4/29/2011

ATTACHMENT 16-2

CONFIDENTIAL BUSINESS INFORMATION

Attachment-Response 16-2

Entire Documents Confidential

Confidential Information Removed

PE11-005

TOYOTA

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ATTACHMENT 17

CONFIDENTIAL BUSINESS INFORMATION

Attachment-Response 17

Entire Documents Confidential

Confidential Information Removed