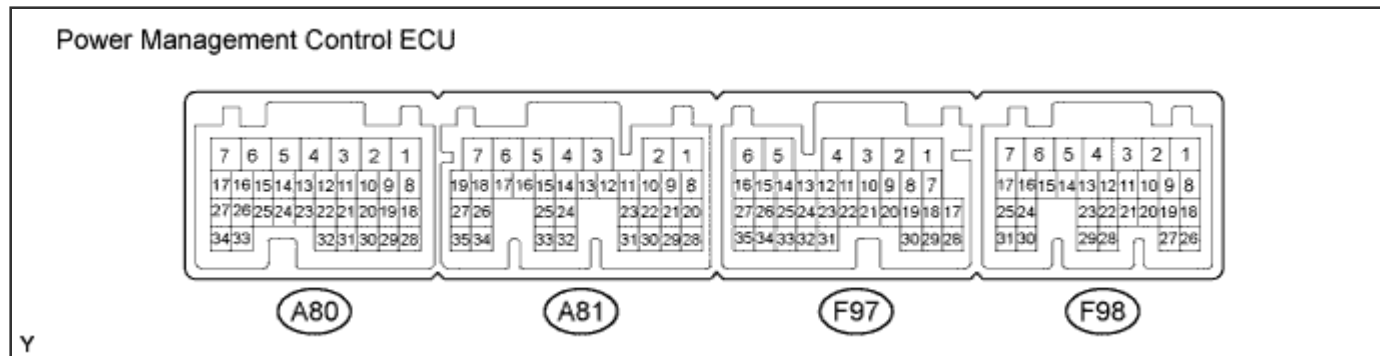


## HYBRID CONTROL SYSTEM TERMINALS OF ECU



### Power management control ECU

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A80-1 (OPM2) - F97-5 (E01)	Y - BR	Oil pump motor	After inspection mode entered, power switch turned on (READY)	11 to 15.5 V
A80-2 (+B2) - F97-6 (E1)	B - BR	Power Source	Power switch on (IG)	11 to 14 V
A80-3 (WP) - F97-5 (E01)	L - BR	A/C WP relay signal	Power switch on (READY), with air conditioning system operating	Below 2 V
A80-4 (FCTL) -	W - BR	Cooling fan relay signal	Power switch on (IG)	Below 2 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
F97-5 (E01)				
A80-11 (VLO) - F97-6 (E1)	G - BR	DC/DC operation monitor / voltage change signal	Power switch on (IG)	Pulse generation (Waveform 1)
A80-13 (IWP) - F97-6 (E1)	L - BR	Inverter water pump assembly signal	Power switch on (READY)	Pulse generation (Waveform 2)
A80-14 (NIWP) - F97-6 (E1)	R - BR	Inverter water pump assembly signal	Power switch on (READY)	Pulse generation (Waveform 2)
A80-15 (BL) - F97-6 (E1)	W - BR	Back up light	Power switch on (IG), shift lever in R	11 to 14 V
A80-16 (GI) - F97-6 (E1)	W - BR	Camshaft position sensor signal	Power switch on (READY), with engine running	Pulse generation (Waveform 3)
A80-18 (SI2) - F97-6 (E1)	LG - BR	HV battery blower fan	Power switch on (IG), during Active Test	Pulse generation (Waveform 4)

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A80-19 (CLK) - F97-6 (E1)	P - BR	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 5)
A80-20 (STB) - F97-6 (E1)	B - BR	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 5)
A80-21 (NODD) - F97-6 (E1)	W - BR	DC/DC operation	Converter operating normally	5 to 7 V
A80-21 (NODD) - F97-6 (E1)	W - BR	DC/DC operation	Converter not operating normally	2 to 4 V
A80-21 (NODD) - F97-6 (E1)	W - BR	DC/DC operation	Converter operating prohibited	0.1 to 0.5 V
A80-22 (RMT) - A80-23 (RMTG)	R - BE	Rear motor temperature sensor	Power switch on (IG), temperature 25°C (77°F)	3.6 to 4.6 V
A80-22 (RMT) - A80-23 (RMTG)	R - BE	Rear motor temperature sensor	Power switch on (IG), temperature 60°C (140°F)	2.2 to 3.2 V
A80-24 (MMT) - A80-25 (MMTG)	G - GR	Motor temperature sensor	Power switch on (IG), temperature 25°C (77°F)	3.6 to 4.6 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A80-24 (MMT) - A80-25 (MMTG)	G - GR	Motor temperature sensor	Power switch on (IG), temperature 60°C (140°F)	2.2 to 3.2 V
A80-26 (GMT) - A80-27 (GMTG)	L - BR	Generator temperature sensor	Power switch on (IG), temperature 25°C (77°F)	3.6 to 4.6 V
A80-26 (GMT) - A80-27 (GMTG)	L - BR	Generator temperature sensor	Power switch on (IG), temperature 60°C (140°F)	2.2 to 3.2 V
A80-28 (SI1) - F97-6 (E1)	R - BR	HV battery blower fan	Power switch on (IG), during Active Test	Pulse generation (Waveform 4)
A80-29 (SI0) - F97-6 (E1)	Y - BR	HV battery blower fan	Power switch on (IG), during Active Test	Pulse generation (Waveform 4)
A80-30 (ETI) - F97-6 (E1)	P - BR	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 5)
A80-31 (ITE) - F97-6 (E1)	W - BR	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 5)

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A80-32 (ILK) - F97-6 (E1)	V - BR	Interlock switch	Power switch on (IG), inverter terminal cover, high-voltage input cables and service plug grip installed correctly	0 to 1.5 V
A80-32 (ILK) - F97-6 (E1)	V - BR	Interlock switch	Power switch on (IG), inverter terminal cover, high-voltage input cables or service plug grip not installed	11 to 14 V
A80-33 (OPM1) - F97-6 (E1)	Y - BR	Oil pump motor	After inspection mode entered, power switch turned on (READY)	Pulse generation (Waveform 6)
A80-34 (OPST) - F97-6 (E1)	L - BR	Oil pump motor	After inspection mode entered, power switch turned on (READY)	Pulse generation (Waveform 6)
A81-1 (IG2) - F97-6 (E1)	R - BR	Power source	Power switch on (IG)	11 to 14 V
A81-2 (IG2D) - F97-6 (E1)	B - BR	IG2 relay	Power switch on (IG)	11 to 14 V
A81-5 (+B1) - F97-6 (E1)	P - BR	Power source	Power switch on (IG)	11 to 14 V
A81-6 (MREL) - F97-6 (E1)	BE - BR	Main relay	Power switch on (IG)	11 to 14 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A81-7 (ST1-) - F97-6 (E1)	BR - BR	Brake cancel switch	Power switch on (IG), brake pedal depressed	0 to 1.5 V
A81-7 (ST1-) - F97-6 (E1)	BR - BR	Brake cancel switch	Power switch on (IG), brake pedal released	11 to 14 V
A81-8 (FD) - F97-6 (E1)	LG - BR	Shift lever position sensor	Power switch on (IG), shift lever in D	11 to 14 V
A81-8 (FD) - F97-6 (E1)	LG - BR	Shift lever position sensor	Power switch on (IG), shift lever not in D	0 to 1.5 V
A81-9 (RV) - F97-6 (E1)	BR - BR	Shift lever position sensor	Power switch on (IG), shift lever in R	11 to 14 V
A81-9 (RV) - F97-6 (E1)	BR - BR	Shift lever position sensor	Power switch on (IG), shift lever not in R	0 to 1.5 V
A81-11 (D) - F97-6 (E1)	Y - BR	Shift lever position sensor	Power switch on (IG), shift lever in D	11 to 14 V
A81-11 (D) - F97-6 (E1)	Y - BR	Shift lever position sensor	Power switch on (IG), shift lever not in D	0 to 1.5 V
A81-12 (N) - F97-6 (E1)	W - BR	Shift lever position sensor	Power switch on (IG), shift lever in N	11 to 14 V
A81-12 (N) -	W - BR	Shift lever position sensor	Power switch on (IG), shift lever not in N	1.2 to 2.8 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
F97-6 (E1)				
A81-14 (R) - F97-6 (E1)	L - BR	Shift lever position sensor	Power switch on (IG), shift lever in R	11 to 14 V
A81-14 (R) - F97-6 (E1)	L - BR	Shift lever position sensor	Power switch on (IG), shift lever not in R	0 to 1.5 V
A81-15 (P) - F97-6 (E1)	G - BR	Shift lever position sensor	Power switch on (IG), shift lever in P	11 to 14 V
A81-15 (P) - F97-6 (E1)	G - BR	Shift lever position sensor	Power switch on (IG), shift lever not in P	0 to 1.5 V
A81-16 (MJ) - F97-6 (E1)	V - BR	Shift lever position sensor	Power switch on (IG), shift lever in P, R, N or D	11 to 14 V
A81-18 (VCP1) - A81-34 (EP1)	G - W	Accelerator pedal position sensor power source (for VPA1)	Power switch on (IG)	4.5 to 5.5 V
A81-19 (VCP2) - A81-35 (EP2)	BR - Y	Accelerator pedal position sensor power source (for VPA2)	Power switch on (IG)	4.5 to 5.5 V
A81-20 (CLK-) - F97-6 (E1)	W - BR	MG communication clock signal	Power switch on (IG)	Pulse generation (Waveform 7)

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A81-21 (CLK+) - F97-6 (E1)	B - BR	MG communication clock signal	Power switch on (IG)	Pulse generation (Waveform 7)
A81-23 (STP) - F97-6 (E1)	R - BR	Stop light switch	Brake pedal depressed	11 to 14 V
A81-23 (STP) - F97-6 (E1)	R - BR	Stop light switch	Brake pedal released	0 to 1.5 V
A81-24 (HTM+) - F97-6 (E1)	B - BR	Communication signal from power management control ECU (HV CPU) to MG ECU	Power switch on (IG)	Pulse generation (Waveform 8)
A81-25 (HTM-) - F97-6 (E1)	W - BR	Communication signal from power management control ECU (HV CPU) to MG ECU	Power switch on (IG)	Pulse generation (Waveform 8)
A81-26 (VPA1) - A81-34 (EP1)	L - W	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG), accelerator pedal released	0.4 to 1.4 V
A81-26 (VPA1) - A81-34 (EP1)	L - W	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG) engine stopped, shift lever in P, accelerator pedal fully depressed	2.6 to 4.5 V
A81-27 (VPA2) - A81-35 (EP2)	R - Y	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG), accelerator pedal released	1.0 to 2.2 V



Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A81-27 (VPA2) - A81-35 (EP2)	R - Y	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG) engine stopped, shift lever in P, accelerator pedal fully depressed	3.4 to 5.3 V
A81-29 (MTH-) - F97-6 (E1)	W - BR	Communication signal from MG ECU to power management control ECU (HV CPU)	Power switch on (IG)	Pulse generation (Waveform 9)
A81-30 (MTH+) - F97-6 (E1)	B - BR	Communication signal from MG ECU to power management control ECU (HV CPU)	Power switch on (IG)	Pulse generation (Waveform 9)
A81-31 (HSDN) - F97-6 (E1)	B - BR	MG ECU shutdown signal	Power switch on (READY)	0 to 1.5 V
A81-32 (REQ-) - F97-6 (E1)	W - BR	MG ECU communication request signal	Power switch on (IG)	Pulse generation (Waveform 10)
A81-33 (REQ+) - F97-6 (E1)	B - BR	MG ECU communication request signal	Power switch on (IG)	Pulse generation (Waveform 10)
F97-1 (AM22) -	SB - BR	Constant power source	Always	11 to 14 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
F97-6 (E1)				
F97-2 (SMRG) - F97-5 (E01)	W - BR	System main relay	Power switch on (IG) → Power switch on (READY)	Pulse generation (Waveform 11)
F97-3 (SMRP) - F97-5 (E01)	B - BR	System main relay	Power switch on (IG) → Power switch on (READY)	Pulse generation (Waveform 11)
F97-4 (SMRB) - F97-5 (E01)	R - BR	System main relay	Power switch on (IG) → Power switch on (READY)	Pulse generation (Waveform 11)
F97-7 (SSW1) - F97-6 (E1)	LG - BR	Power switch	Power switch pressed and held	0 to 1.5 V
F97-8 (INDS) - F97-6 (E1)	V - BR	Power switch indicator	Brake pedal depressed, key certification OK	5 to 12.5 V
F97-9 (INDW) - F97-6 (E1)	Y - BR	Power switch indicator	Power switch on (IG), brake pedal released	5 to 12.5 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
F97-11 (TC) - F97-6 (E1)	BR - BR	Diagnosis terminal	Power switch on (IG)	11 to 14 V
F97-13 (EVSW) - F97-6 (E1)	LG - BR	EV switch signal	Power switch on (IG), EV switch not operated	11 to 14 V
F97-13 (EVSW) - F97-6 (E1)	LG - BR	EV switch signal	Power switch on (IG), EV switch operated	0 to 1.5 V
F97-14 (SPDI) - F97-6 (E1)	L - BR	Vehicle speed signal	Driving at approximately 20 km/h (12 mph) with power switch on (READY)	Pulse generation (Waveform 12)
F97-28 (THB) - F97-30 (ETHB)	SB - P	Auxiliary battery temperature	Power switch on (IG), auxiliary battery temperature 25°C (77°F)	1.7 to 2.3 V
F97-28 (THB) - F97-30 (ETHB)	SB - P	Auxiliary battery temperature	Power switch on (IG), auxiliary battery temperature 60°C (140°F)	0.6 to 0.9 V
F97-29 (ABFS) - F97-6 (E1)	LG - BR	Airbag activation signal	Power switch on (READY)	Pulse generation (Waveform 13)
F97-32 (BTH+) - F97-6 (E1)	Y - BR	Communication signal from battery smart unit to power management	Power switch on (IG)	Pulse

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
		control ECU (HV CPU)		generation (Waveform 14)
F97-33 (BTH-) - F97-6 (E1)	BR - BR	Communication signal from battery smart unit to power management control ECU (HV CPU)	Power switch on (IG)	Pulse generation (Waveform 14)
F97-34 (CA2H) - F97-6 (E1)	G - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 15)
F97-35 (CA2L) - F97-6 (E1)	L - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 15)
F98-1 (ACCD) - F97-6 (E1)	GR - BR	ACC relay	Power switch on (ACC)	11 to 14 V
F98-2 (IG1D) - F97-6 (E1)	G - BR	IG1 relay	Power switch on (IG)	11 to 14 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
F98-7 (AM21) - F97-6 (E1)	R - BR	Constant power source	Always	11 to 14 V
F98-11 (LIN2) - F97-6 (E1)	V - BR	LIN communication system	Power switch on (IG), brake pedal depressed	Pulse generation
F98-17 (SSW2) - F97-6 (E1)	B - BR	Power switch	Power switch pressed and held	11 to 14 V
F98-18 (PSOK) - F97-6 (E1)	GR - BR	Electric power steering permission signal	After power switch on (READY), 2 seconds or more elapsed	Pulse generation (Waveform 16)
F98-20 (IMO) - F97-6 (E1)	LG - BR	Immobiliser communication	Power switch off → Power switch on (IG) → Power switch on (READY)	Pulse generation (Waveform 17)
F98-21 (IMI) - F97-6 (E1)	P - BR	Immobiliser communication	Power switch off → Power switch on (IG) → Power switch on (READY)	Pulse generation (Waveform 17)
F98-23 (M) - F97-6 (E1)	R - BR	Transmission control switch	Power switch on (IG), shift lever in S	11 to 14 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
F98-23 (M) - F97-6 (E1)	R - BR	Transmission control switch	Power switch on (IG), shift lever not in S	0 to 1.5 V
F98-24 (CA1L) - F97-6 (E1)	R - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 18)
F98-25 (CA1H) - F97-6 (E1)	LG - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 18)
F98-26 (SFTD) - F97-6 (E1)	Y - BR	Transmission control switch	Power switch on (IG), shift lever in S	11 to 14 V
F98-26 (SFTD) - F97-6 (E1)	Y - BR	Transmission control switch	Power switch on (IG), shift lever in negative (-) side	0 to 1.5 V
F98-27 (SFTU) - F97-6 (E1)	W - BR	Transmission control switch	Power switch on (IG), shift lever in S	11 to 14 V
F98-27 (SFTU) - F97-6 (E1)	W - BR	Transmission control switch	Power switch on (IG), shift lever in positive (+) side	0 to 1.5 V
F98-30 (CA3N) - F97-6 (E1)	W - BR	CAN communication system	Power switch on (IG)	Pulse

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
				generation (Waveform 19)
F98-31 (CA3P) - F97-6 (E1)	V - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 19)

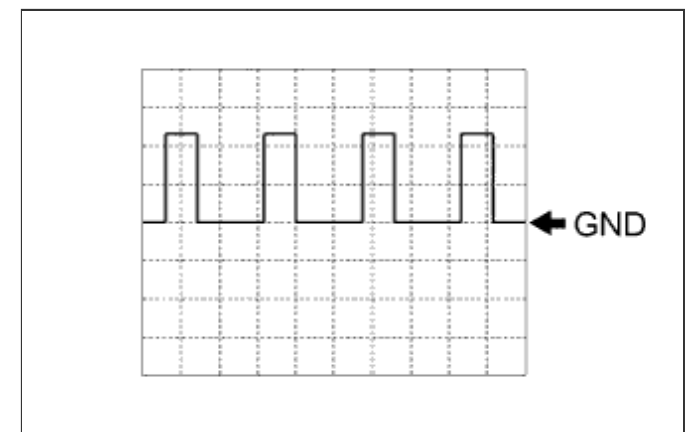
## 1. Oscilloscope waveforms

### Tech Tips

Oscilloscope waveform samples are provided here for informational purposes. Noise and fluttering waveforms have been omitted.

a.

**Waveform 1 (DC/DC operation monitor / voltage change signal)**

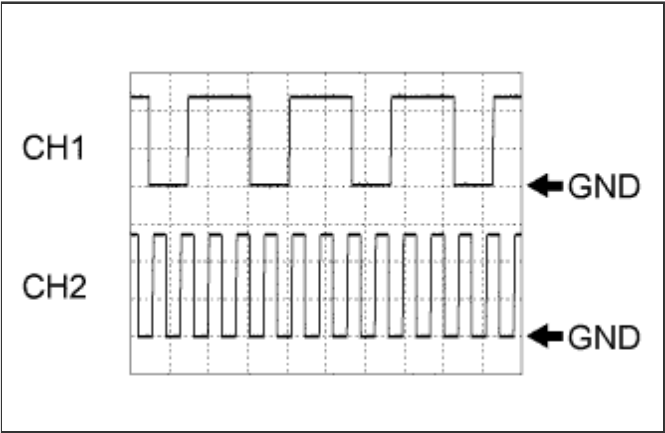


Item	Content
Terminal	A80-11 (VLO) - F97-6 (E1)
Equipment Setting	5 V/DIV., 50 ms./DIV.
Condition	Power switch on (IG)

**Tech Tips**

The cycle will vary depending on the specified voltage of the hybrid vehicle converter.

- b.
- Waveform 2 (inverter water pump assembly signal)**

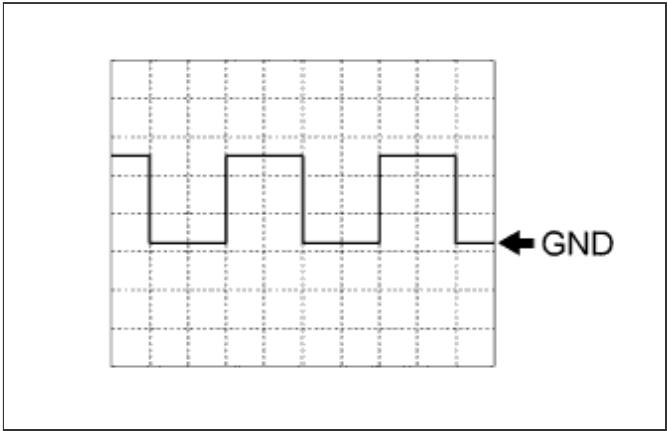


Item	Content
Terminal	CH1: A80-13 (IWP) - F97-6 (E1) CH2: A80-14 (NIWP) - F97-6 (E1)
Equipment Setting	5 V/DIV., 50 ms./DIV.



Item	Content
Condition	Power switch on (READY)

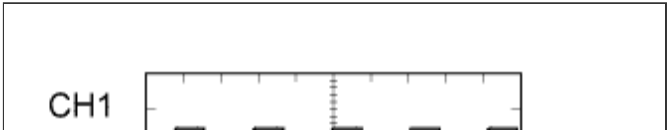
c.  
**Waveform 3 (Camshaft position sensor signal)**

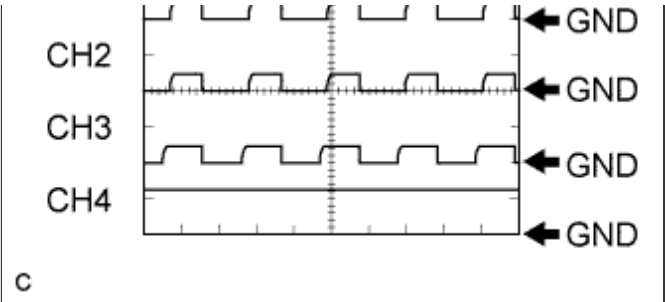


Item	Content
Terminal	A80-16 (GI) - F97-6 (E1)
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Power switch on (READY) with engine running

**Tech Tips**  
The pulse cycle becomes shorter as the engine speed increases.

d.  
**Waveform 4 (HV battery blower fan operation signal)**





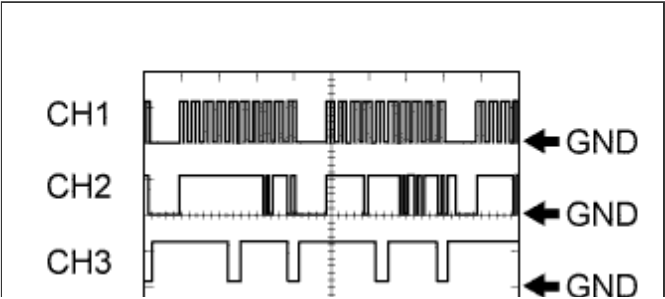
Item	Content
Terminal	CH1: A80-29 (SI0) - F97-6 (E1) CH2: A80-28 (SI1) - F97-6 (E1) CH3: A80-18 (SI2) - F97-6 (E1) CH4: A80-4 (FCTL) - F97-6 (E1)
Equipment Setting	10 V/DIV., 1 ms./DIV.
Condition	Power switch on (IG), during Active Test

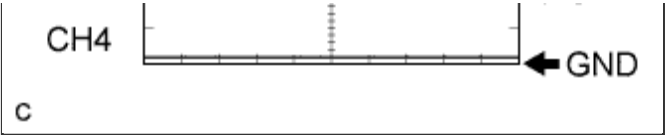
**Tech Tips**

The waveform will vary depending on the content of the digital communication (digital signal).

e.

**Waveform 5 (A/C communication signal)**





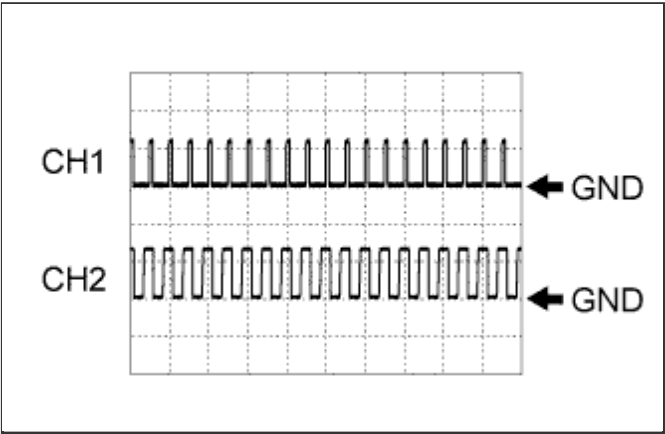
Item	Content
Terminal	CH1: A80-19 (CLK) - F97-6 (E1) CH2: A80-31 (ITE) - F97-6 (E1) CH3: A80-30 (ETI) - F97-6 (E1) CH4: A80-20 (STB) - F97-6 (E1)
Equipment Setting	10 V/DIV., 100 ms./DIV.
Condition	Power switch on (READY) with air conditioning system stopped

**Tech Tips**

The waveform will vary depending on the content of the digital communication (digital signal).

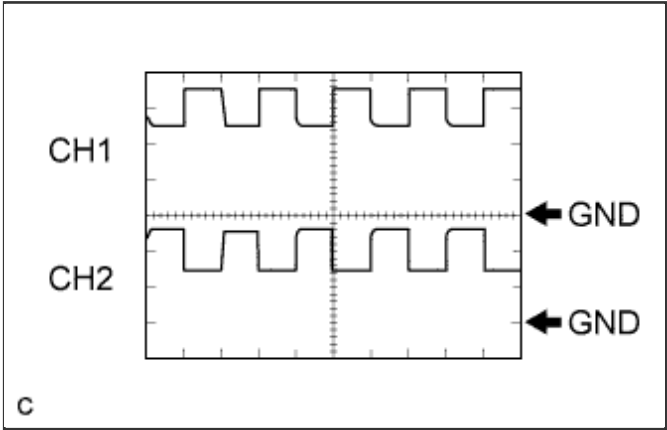
f.

**Waveform 6 (oil pump motor signal)**



Item	Content
Terminal	CH1: A80-33 (OPM1) - F97-6 (E1) CH2: A80-34 (OPST) - F97-6 (E1)
Equipment Setting	10 V/DIV., 20 ms./DIV.
Condition	After inspection mode entered, power switch turned on (READY)

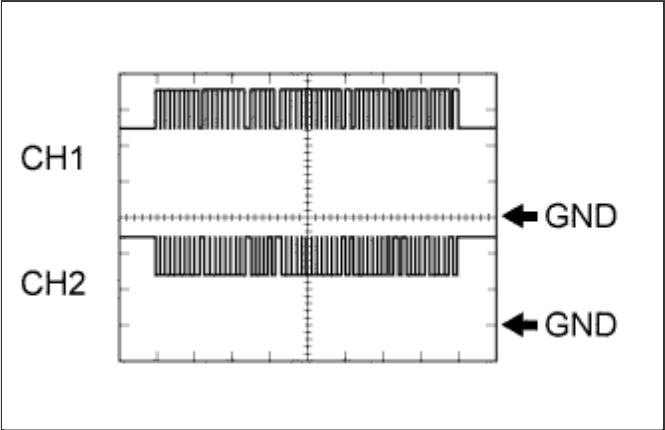
**g.**  
**Waveform 7 (MG communication clock signal)**



Item	Content
Terminal	CH1: A81-21 (CLK+) - F97-6 (E1) CH2: A81-20 (CLK-) - F97-6 (E1)
Equipment Setting	1 V/DIV., 1 $\mu$ s./DIV.

Item	Content
Condition	Power switch on (IG)

h.  
**Waveform 8 (communication signal from power management control ECU (HV CPU) to MG ECU)**



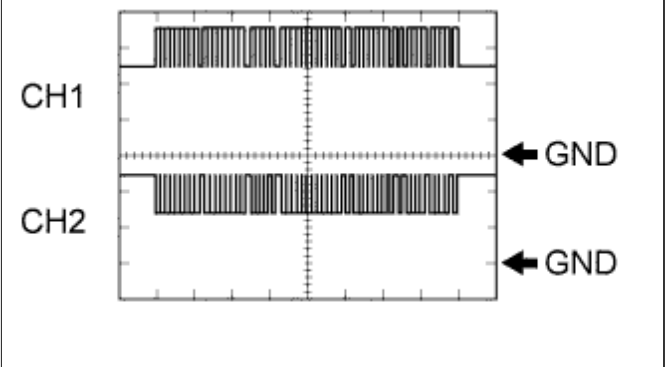
Item	Content
Terminal	CH1: A81-24 (HTM+) - F97-6 (E1) CH2: A81-25 (HTM-) - F97-6 (E1)
Equipment Setting	1 V/DIV., 200 $\mu$ s./DIV.
Condition	Power switch on (IG)

**Tech Tips**  
The waveform will vary depending on the content of the digital communication (digital signal).

i.  
**Waveform 9 (communication signal from MG ECU to power management control**



ECU (HV CPU))



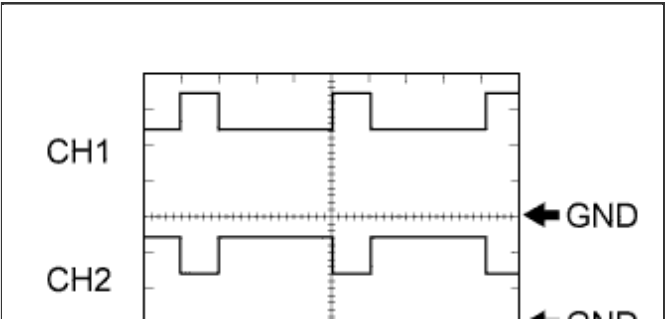
Item	Content
Terminal	CH1: A81-30 (MTH+) - F97-6 (E1) CH2: A81-29 (MTH-) - F97-6 (E1)
Equipment Setting	1 V/DIV., 200 μs./DIV.
Condition	Power switch on (IG)

Tech Tips

The waveform will vary depending on the content of the digital communication (digital signal).

j.

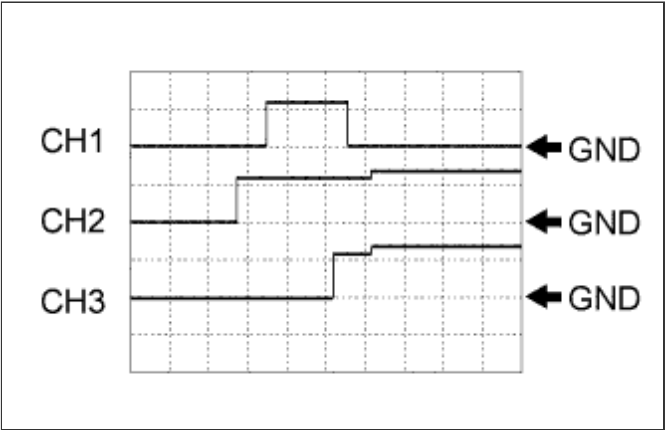
Waveform 10 (MG ECU communication request signal)





Item	Content
Terminal	CH1: A81-33 (REQ+) - F97-6 (E1) CH2: A81-32 (REQ-) - F97-6 (E1)
Equipment Setting	1 V/DIV., 1 ms./DIV.
Condition	Power switch on (IG)

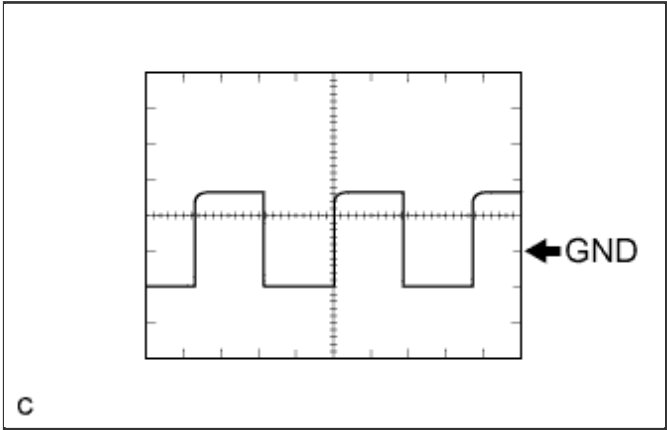
k.  
**Waveform 11 (system main relay operation signal)**



Item	Content
Terminal	CH1: F97-3 (SMRP) - F97-6 (E1)

Item	Content
	CH2: F97-4 (SMRB) - F97-6 (E1) CH3: F97-2 (SMRG) - F97-6 (E1)
Equipment Setting	10 V/DIV., 200 ms./DIV.
Condition	Power switch on (IG) → Power switch on (READY)

I.  
**Waveform 12 (vehicle speed signal)**



Item	Content
Terminal	F97-14 (SPDI) - F97-6 (E1)
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Driving at approximately 20 km/h (12 mph) with power switch on (READY)



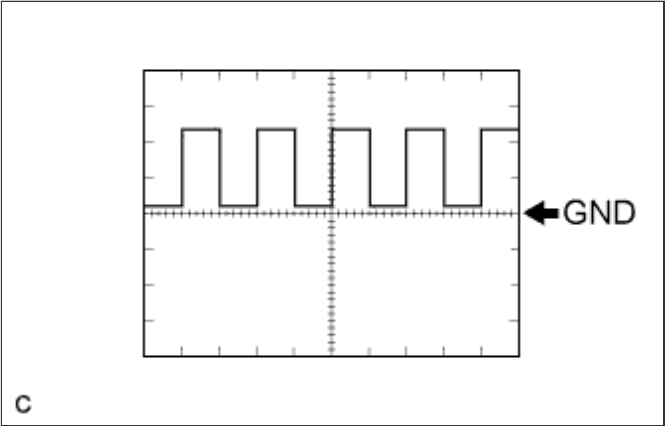
Tech Tips

The higher the vehicle speed, the shorter the cycle.

m.

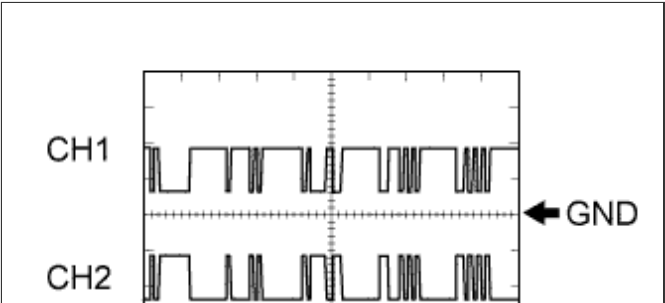
Waveform 13 (airbag deployment signal)

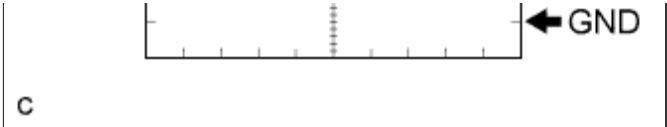
Item	Content
Terminal	F97-29 (ABFS) - F97-6 (E1)
Equipment Setting	5 V/DIV., 500 ms./DIV.
Condition	Power switch on (READY)



n.

Waveform 14 (communication signal from battery smart unit to power management control ECU (HV CPU))





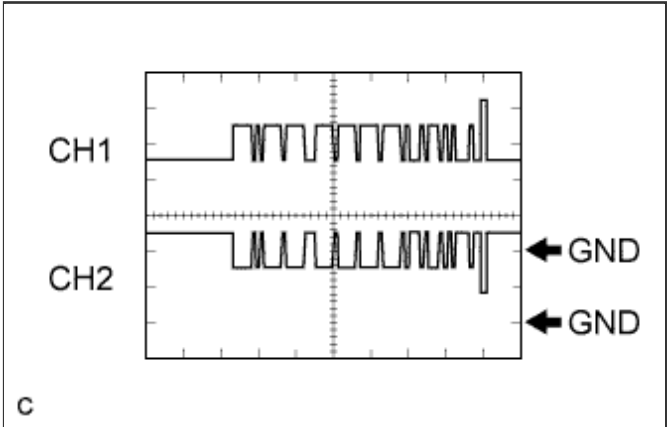
Item	Content
Terminal	CH1: F97-32 (BTH+) - F97-6 (E1) CH2: F97-33 (BTH-) - F97-6 (E1)
Equipment Setting	2 V/DIV., 500 $\mu$ s./DIV.
Condition	Power switch on (IG)

**Tech Tips**

The waveform will vary depending on the content of the digital communication (digital signal).

o.

**Waveform 15 (CAN communication signal)**



Item	Content
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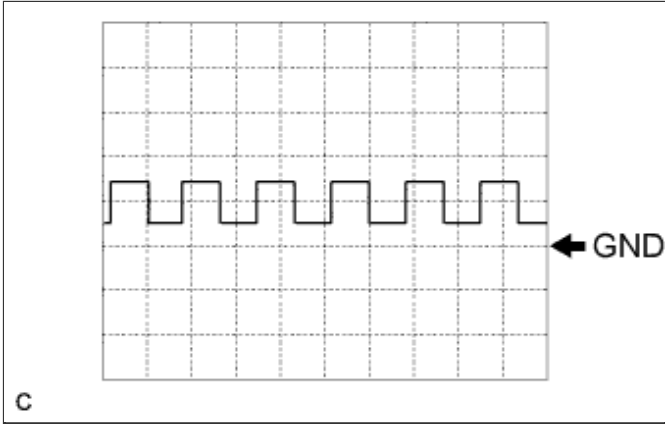
Item	Content
Terminal	CH1: F97-34 (CA2H) - F97-6 (E1) CH2: F97-35 (CA2L) - F97-6 (E1)
Equipment Setting	1 V/DIV., 50 μs./DIV.
Condition	Power switch on (IG)

**Tech Tips**

The waveform will vary depending on the content of the digital communication (digital signal).

p.

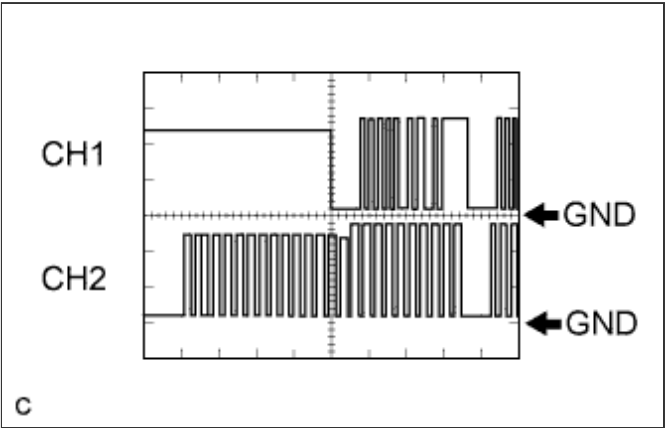
**Waveform 16 (electric power steering permission signal)**



Item	Content
Terminal	F98-18 (PSOK) - F97-6 (E1)
Equipment Setting	5 V/DIV., 50 ms./DIV.

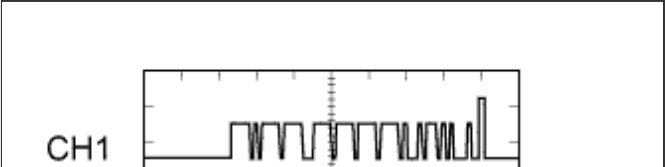
Item	Content
Condition	After power switch on (READY), 2 seconds or more elapsed

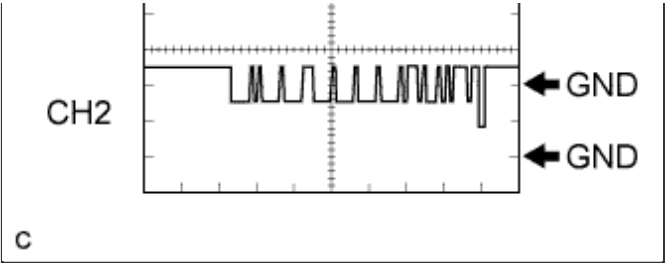
q.  
**Waveform 17 (immobiliser communication signal)**



Item	Content
Terminal	CH1: F98-20 (IMO) - F97-6 (E1) CH2: F98-21 (IMI) - F97-6 (E1)
Equipment Setting	5 V/DIV., 200 ms./DIV.
Condition	Power switch off → Power switch on (IG) → Power switch on (READY)

r.  
**Waveform 18 (CAN communication signal)**





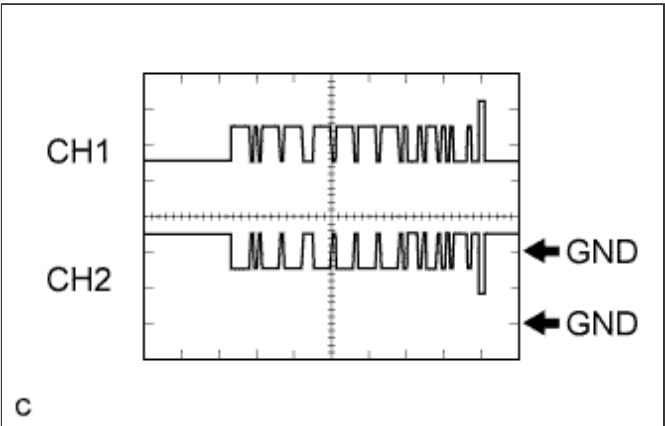
Item	Content
Terminal	CH1: F98-25 (CA1H) - F97-6 (E1) CH2: F98-24 (CA1L) - F97-6 (E1)
Equipment Setting	1 V/DIV., 50 $\mu$ s./DIV.
Condition	Power switch on (IG)

**Tech Tips**

The waveform will vary depending on the content of the digital communication (digital signal).

s.

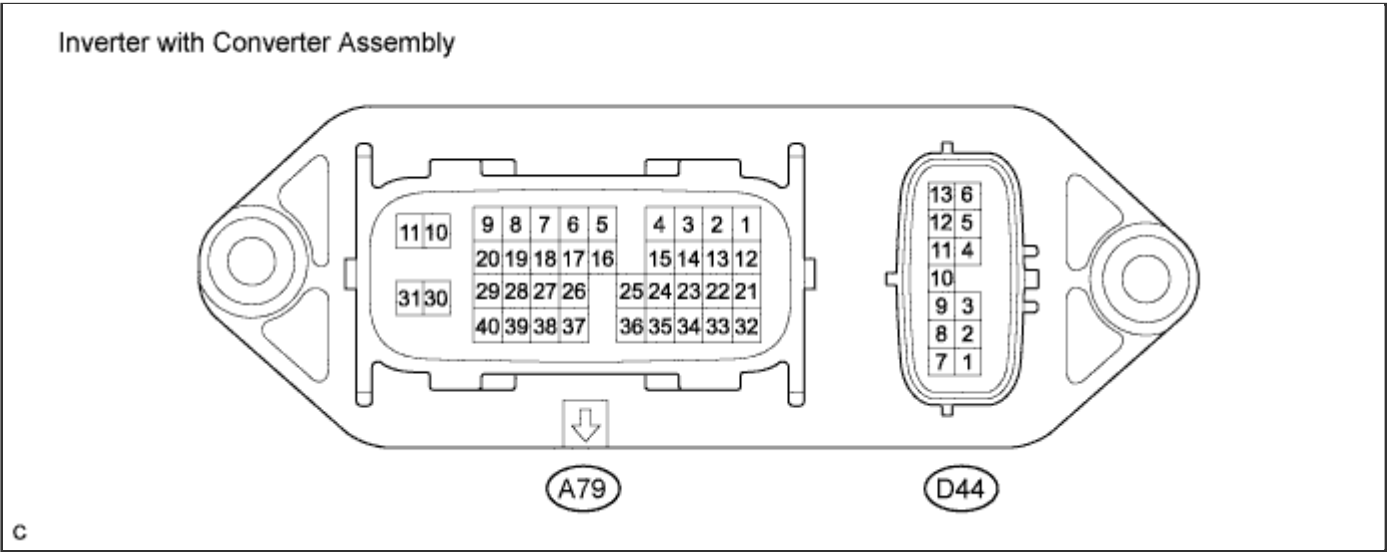
**Waveform 19 (CAN communication signal)**



Item	Content
Terminal	CH1: F98-31 (CA3P) - F97-6 (E1) CH2: F98-30 (CA3N) - F97-6 (E1)
Equipment Setting	1 V/DIV., 50 μs./DIV.
Condition	Power switch on (IG)

**Tech Tips**

The waveform will vary depending on the content of the digital communication (digital signal).



**Tech Tips**

Since the inverter with converter assembly uses waterproof connectors, the voltage and waveform cannot be inspected directly. Standard voltage readings

and waveforms are indicated for reference only.

#### Inverter with converter assembly

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Standard Condition
A79-1 (GI) - A79-10 (GND1)	B - W-B	GI signal	Power switch on (READY) with engine running	Pulse generation (Waveform 1)
A79-4 (VLO) - A79-10 (GND1)	G - W-B	DC/DC operation monitor / voltage change signal	Power switch on (IG)	Pulse generation (Waveform 2)
A79-5 (ILKO) - A79-10 (GND1)	B - W-B	Interlock switch signal	Power switch on (IG), inverter terminal cover, high-voltage input cables and service plug grip installed correctly	Below 1 V
A79-5 (ILKO) - A79-10 (GND1)	B - W-B	Interlock switch signal	Power switch on (IG), inverter terminal cover, high-voltage input cables or service plug grip not installed	11 to 14 V
A79-7 (CLK+) - A79-10 (GND1)	B - W-B	Communication clock signal	Power switch on (READY)	Pulse generation (Waveform 3)

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Standard Condition
A79-8 (MTH+) - A79-10 (GND1)	B - W-B	Communication signal from MG ECU to power management control ECU (HV CPU)	Power switch on (READY)	Pulse generation (Waveform 4)
A79-9 (HTM+) - A79-10 (GND1)	B - W-B	Communication signal from power management control ECU (HV CPU) to MG ECU	Power switch on (READY)	Pulse generation (Waveform 5)
A79-16 (ILKI) - A79-10 (GND1)	V - W-B	Interlock switch signal	Power switch on (IG), inverter terminal cover, high-voltage input cables and service plug grip installed correctly	Below 1 V
A79-16 (ILKI) - A79-10 (GND1)	V - W-B	Interlock switch signal	Power switch on (IG), inverter terminal cover, high-voltage input cables or service plug grip not installed	11 to 14
A79-18 (CLK-) - A79-10 (GND1)	W - W-B	Communication clock signal	Power switch on (READY)	Pulse generation (Waveform 3)
A79-19 (MTH-) - A79-10 (GND1)	W - W-B	Communication signal from MG ECU to power management control ECU (HV CPU)	Power switch on (READY)	Pulse generation (Waveform



Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Standard Condition
				4)
A79-20 (HTM-) - A79-10 (GND1)	W - W-B	Communication signal from power management control ECU (HV CPU) to MG ECU	Power switch on (READY)	Pulse generation (Waveform 5)
A79-24 (NODD) - A79-10 (GND1)	W - W-B	DC/DC operation	Converter operating normally	5 to 7 V
A79-24 (NODD) - A79-10 (GND1)	W - W-B	DC/DC operation	Converter not operating normally	2 to 4 V
A79-24 (NODD) - A79-10 (GND1)	W - W-B	DC/DC operation	Converter operation prohibited	0.1 to 0.5 V
A79-25 (IGCT) - A79-10 (GND1)	L - W-B	MG ECU power source	Power switch on (IG)	11 to 14 V
A79-26 (REQ+) - A79-10 (GND1)	B - W-B	Communication request signal	Power switch on (READY)	Pulse generation (Waveform 6)

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Standard Condition
A79-30 (+B) - A79-10 (GND1)	R - W-B	MG ECU power source	Power switch on (IG)	11 to 14 V
A79-31 (+B2) - A79-10 (GND1)	G - W-B	MG ECU power source	Power switch on (IG)	11 to 14 V
A79-32 (RCS) - A79-21 (RCSG)	W - Y	Rear motor resolver signal	Rear motor resolver running	Pulse generation (Waveform 7)
A79-33 (RSN) - A79-22 (RSNG)	L - R	Rear motor resolver signal	Rear motor resolver running	Pulse generation (Waveform 7)
A79-34 (RRF) - A79-23 (RRFG)	BR - G	Rear motor resolver signal	Rear motor resolver running	Pulse generation (Waveform 7)
A79-24 (S) - A79-10 (GND1)	P - W-B	Auxiliary battery voltage monitor	Power switch on (IG)	11 to 14 V
A79-37 (REQ-) - A79-10 (GND1)	W - W-B	MG ECU communication request signal	Power switch on (READY)	Pulse generation

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Standard Condition
				(Waveform 6)
A79-40 (HSDN) - A79-10 (GND1)	B - W-B	MG shutdown signal	Power switch on (READY)	0 to 1 V
D44-1 (GRF) - D44-7 (GRFG)	BR - G	Generator resolver signal	Generator resolver running	Pulse generation (Waveform 8)
D44-2 (GSN) - D44-8 (GSNG)	L - R	Generator resolver signal	Generator resolver running	Pulse generation (Waveform 8)
D44-3 (GCS) - D44-9 (GCSG)	W - Y	Generator resolver signal	Generator resolver running	Pulse generation (Waveform 8)
D44-4 (MRF) - D44-11 (MRFG)	BR - G	Motor resolver signal	Motor resolver running	Pulse generation (Waveform 9)

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Standard Condition
D44-5 (MSN) - D44-12 (MSNG)	L - R	Motor resolver signal	Motor resolver running	Pulse generation (Waveform 9)
D44-6 (MCS) - D44-13 (MCSG)	W - Y	Motor resolver signal	Motor resolver running	Pulse generation (Waveform 9)

### Note

Do not measure the voltage or waveform directly at the sealed side of the inverter with converter assembly connector. Doing so may damage the connector because the connector is waterproof.

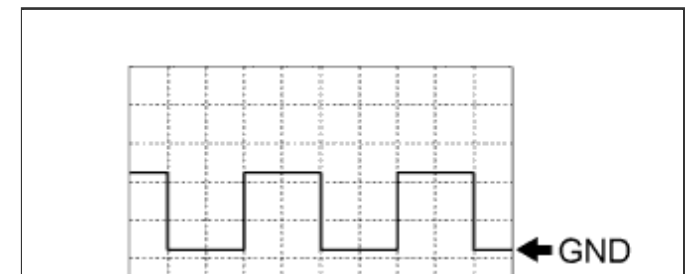
## 2. Oscilloscope waveforms

### Tech Tips

Oscilloscope waveform samples are provided here for informational purposes. Noise and fluttering waveforms have been omitted.

a.

**Waveform 1 (GI signal)**



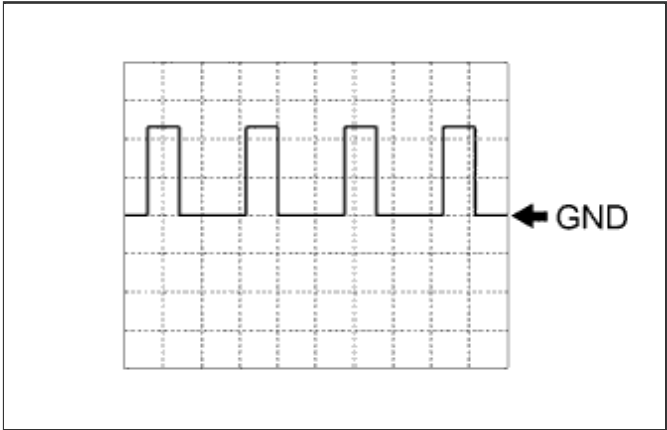


Item	Content
Terminal	A79-1 (GI) - A79-10 (GND1)
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Power switch on (READY) with engine running

**Tech Tips**

The pulse cycle becomes shorter as the engine speed increases.

- b.
- Waveform 2 (DC/DC operation monitor / voltage change signal)**



Item	Content
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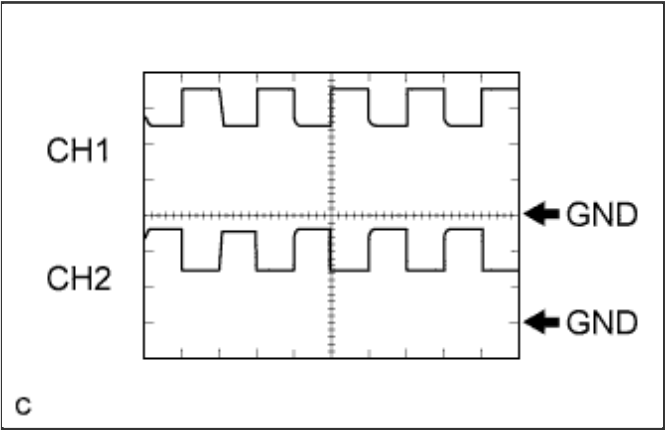
Item	Content
Terminal	A79-4 (VLO) - A79-10 (GND1)
Equipment Setting	5 V/DIV., 50 ms./DIV.
Condition	Power switch on (IG)

**Tech Tips**

The cycle will vary depending on the specified voltage of the hybrid vehicle converter.

c.

**Waveform 3 (MG ECU communication clock signal)**

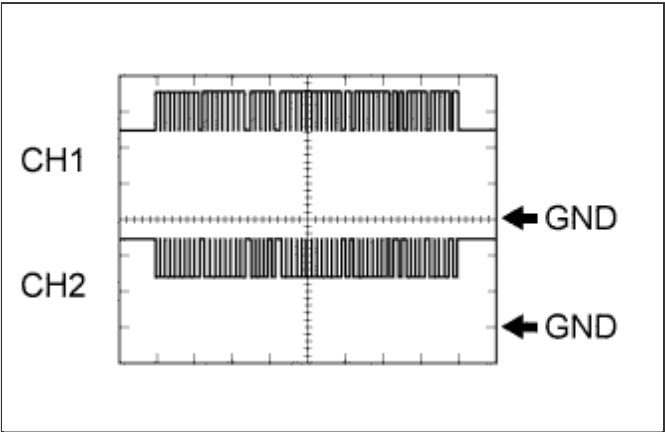


Item	Content
Terminal	CH1: A79-7 (CLK+) - A79-10 (GND1) CH2: A79-18 (CLK-) - A79-10 (GND1)
Equipment Setting	1 V/DIV., 1 $\mu$ s./DIV.

Item	Content
Condition	Power switch on (READY)

d.

**Waveform 4 (communication signal from MG ECU to power management control ECU (HV CPU))**



Item	Content
Terminal	CH1: A79-8 (MTH+) - A79-10 (GND1) CH2: A79-19 (MTH-) - A79-10 (GND1)
Equipment Setting	1 V/DIV., 200 μs./DIV.
Condition	Power switch on (READY)

**Tech Tips**

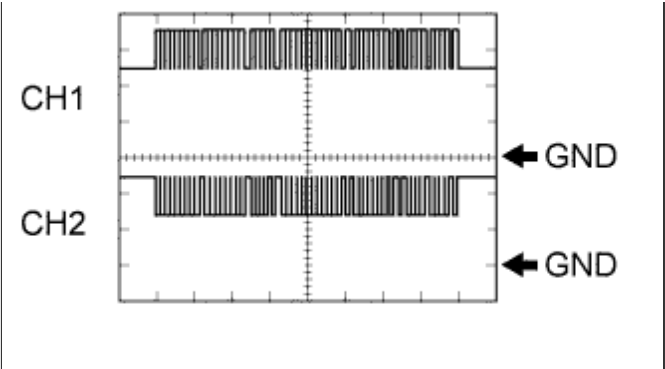
The waveform will vary depending on the content of the digital communication (digital signal).

e.

**Waveform 5 (communication signal from power management control ECU (HV**



CPU) to MG ECU)



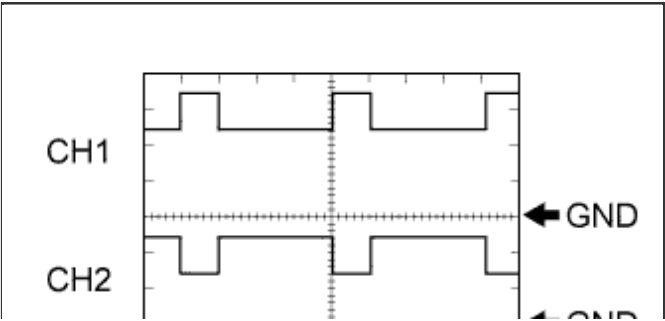
Item	Content
Terminal	CH1: A79-9 (HTM+) - A79-10 (GND1) CH2: A79-20 (HTM-) - A79-10 (GND1)
Equipment Setting	1 V/DIV., 200 μs./DIV.
Condition	Power switch on (READY)

**Tech Tips**

The waveform will vary depending on the content of the digital communication (digital signal).

f.

**Waveform 6 (MG ECU communication request signal)**

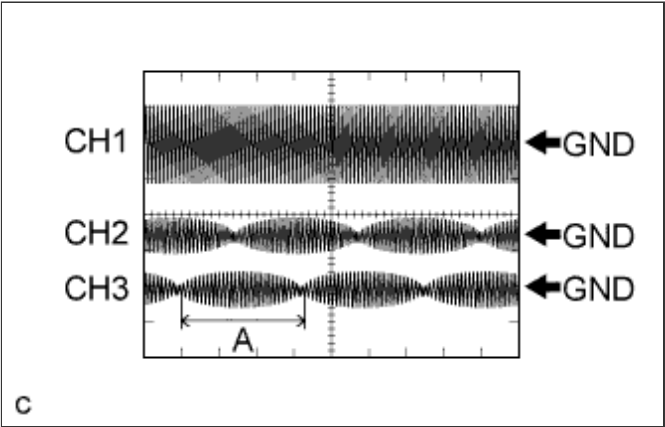
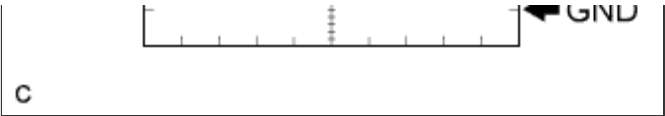




Item	Content
Terminal	CH1: A79-26 (REQ+) - A79-10 (GND1) CH2: A79-37 (REQ-) - A79-10 (GND1)
Equipment Setting	1 V/DIV., 1 ms./DIV.
Condition	Power switch on (READY)

g.  
Waveform 7 (rear motor resolver signal)

Item	Content
Terminal	CH1: A79-34 (RRF) - A79-23 (RRFG)



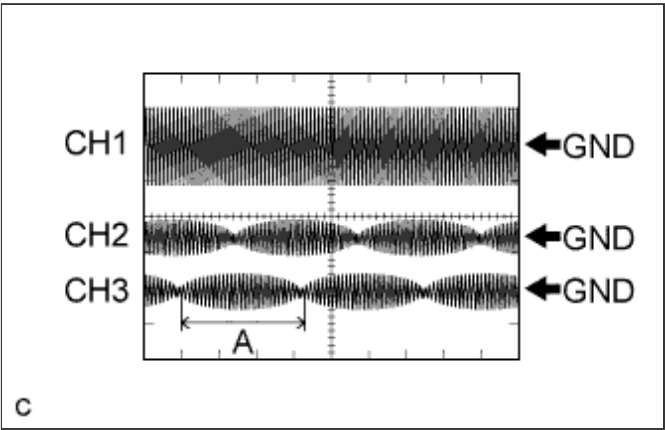
Item	Content
	CH2: A79-33 (RSN) - A79-22 (RSNG) CH3: A79-32 (RCS) - A79-21 (RCSG)
Equipment Setting	CH1: 10 V/DIV., 1 ms./DIV. CH2, 3: .5 V/DIV., 1 ms./DIV.
Condition	Resolver motor resolver running

**Tech Tips**

Pulse cycle A becomes shorter as the rotor speed increases.

h.

**Waveform 8 (generator resolver signal)**



Item	Content
Terminal	CH1: D44-1 (GRF) - D44-7 (GRFG)

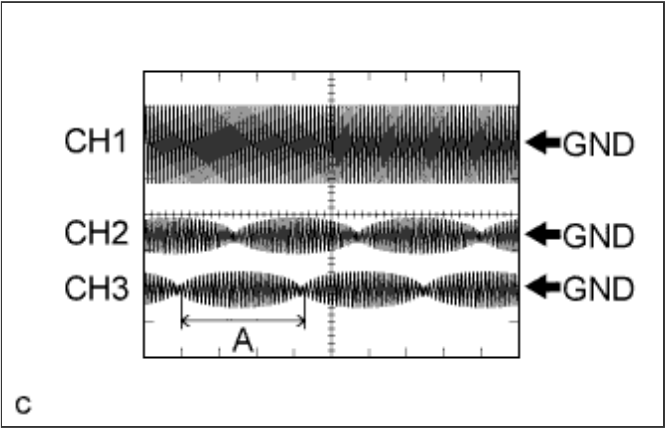
Item	Content
	CH2: D44-2 (GSN) - D44-8 (GSNG) CH3: D44-3 (GCS) - D44-9 (GCSG)
Equipment Setting	CH1: 10 V/DIV., 1 ms./DIV. CH2, 3: 5 V/DIV., 1 ms./DIV.
Condition	Generator resolver running

**Tech Tips**

Pulse cycle A becomes shorter as the rotor speed increases.

i.

**Waveform 9 (motor resolver signal)**



Item	Content
Terminal	CH1: D44-4 (MRF) - D44-11 (MRFG)

Item	Content
	CH2: D44-5 (MSN) - D44-12 (MSNG) CH3: D44-6 (MCS) - D44-13 (MCSG)
Equipment Setting	CH1: 10 V/DIV., 1 ms./DIV. CH2, 3: 5 V/DIV., 1 ms./DIV.
Condition	Motor resolver running

### Tech Tips

Pulse cycle A becomes shorter as the rotor speed increases.