

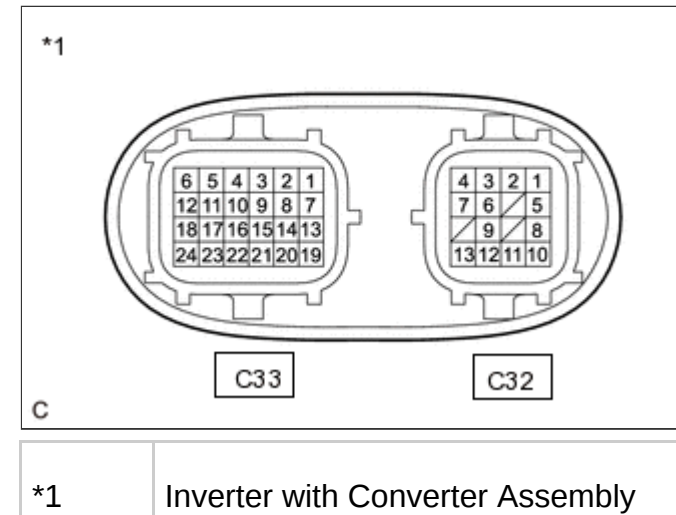
MOTOR GENERATOR CONTROL SYSTEM(for LITHIUM-ION BATTERY) TERMINALS OF ECU

1. Tip

Since the inverter with converter assembly uses waterproof connectors, the voltage and waveforms cannot be inspected directly. Standard voltage readings and waveforms are indicated for reference only.

Table 1. Inverter with Converter Assembly

| Terminal No. (Symbol) | Wiring Color | Input/Output | Terminal Description | Condition | Standard Condition |
|------------------------------|--------------|--------------|---|----------------------|----------------------------------|
| C33-1 (CANH) - C33-24 (GND1) | GR - W-B | Input/Output | CAN communication signal | Power switch on (IG) | Pulse generation (Waveform 1) |
| C33-5 (+B2) - C33-24 (GND1) | R - W-B | Input | Motor generator control ECU (MG ECU) power source | Power switch on (IG) | 11 to 14 V |
| C33-6 (+B) - C33-24 | R - W-B | Input | Motor generator control ECU | Power switch on (IG) | 11 to 14 V |



| Terminal No. (Symbol) | Wiring Color | Input/Output | Terminal Description | Condition | Standard Condition |
|--|--------------|--------------|---|---|--|
| (GND1) | | | (MG ECU) power source | | |
| C33-7 (CANL) - C33-24 (GND1) | W - W-B | Input/Output | CAN communication signal | Power switch on (IG) | Pulse generation (Waveform 1) |
| C33-10 (GI) - C33-24 (GND1) | W - W-B | Input | Camshaft position sensor signal | Power switch on (READY), engine running | Pulse generation (Waveform 2) |
| C33-12 (IGCT) - C33-24 (GND1) | G - W-B | Input | Motor generator control ECU (MG ECU) power source | Power switch on (IG) | 11 to 14 V |
| C33-17 (NE) - C33-24 (GND1) | L - W-B | Input | Crankshaft position sensor signal | Power switch on (READY), engine running | Pulse generation (Waveform 3) |

| Terminal No. (Symbol) | Wiring Color | Input/Output | Terminal Description | Condition | Standard Condition |
|--|--------------|--------------|--------------------------|-------------------------------|--|
| C33-19 (HMCL) - C33-24 (GND1) | W - W-B | Input/Output | Communication signal | Power switch on (IG) | Pulse generation (Waveform 4) |
| C33-20 (HMCH) - C33-24 (GND1) | B - W-B | Input/Output | Communication signal | Power switch on (IG) | Pulse generation (Waveform 4) |
| C33-22 (HSDN) - C33-24 (GND1) | B - W-B | Input | MG shutdown signal | Power switch on (READY) | 0 to 1 V |
| C32-1 (MSN) - C32-2 (MSNG) | GR - LG | Input | Motor resolver signal | Motor resolver running | Pulse generation (Waveform 5) |
| C32-3 (MCSG) | SB - BR | Input | Motor resolver signal | Motor resolver | Pulse generation |

| Terminal No. (Symbol) | Wiring Color | Input/Output | Terminal Description | Condition | Standard Condition |
|---------------------------------------|--------------|--------------|-------------------------------------|----------------------------|----------------------------------|
| - C32-4 (MCS) | | | | running | (Waveform 5) |
| C32-5 (MRF) - C32-6 (MRFG) | P - V | Output | Motor resolver reference signal | Motor resolver running | Pulse generation (Waveform 5) |
| C32-8 (GRF) - C32-9 (GRFG) | Y - L | Output | Generator resolver reference signal | Generator resolver running | Pulse generation (Waveform 6) |
| C32-10 (GSN) - C32-11 (GSNG) | G - W | Input | Generator resolver signal | Generator resolver running | Pulse generation (Waveform 6) |
| C32-12 (GCSG) - C32-13 (GCS) | B - R | Input | Generator resolver signal | Generator resolver running | Pulse generation (Waveform 6) |

| Terminal No. (Symbol) | Wiring Color | Input/Output | Terminal Description | Condition | Standard Condition |
|--------------------------|--------------|--------------|----------------------|-----------|--------------------|
| | | | | | 6) |

Note:

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

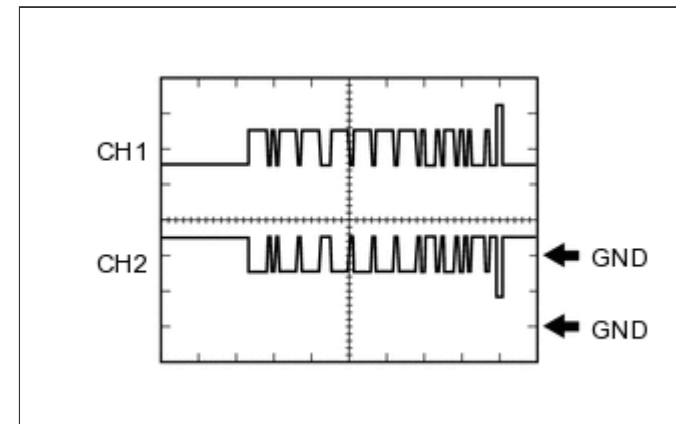
2. **Oscilloscope waveforms**

Tip

Oscilloscope waveforms shown in the illustrations are examples for reference only. Noise, chattering, etc. are not shown.

a. Waveform 1 (CAN communication signal)

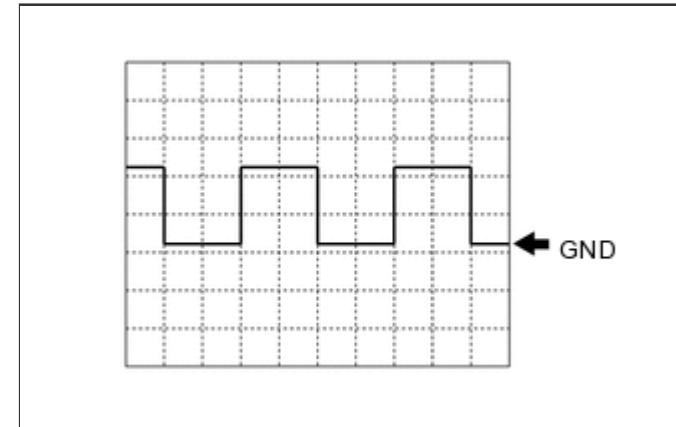
| Item | Content |
|-------------------|--|
| Terminal | CH1: C33-1 (CANH) - C33-24 (GND1) CH2: C33-7 (CANL) - C33-24 (GND1) |
| Equipment Setting | 1 V/DIV., 50 μ s./DIV. |



| Item | Content |
|-----------|----------------------|
| Condition | Power switch on (IG) |

b. Waveform 2 (camshaft position sensor signal)

| Item | Content |
|-------------------|---|
| Terminal | C33-10 (GI) - C33-24 (GND1) |
| Equipment Setting | 5 V/DIV., 20 ms./DIV. |
| Condition | Power switch on (READY), engine running |



Tip

The wavelength becomes shorter as the engine speed increases.

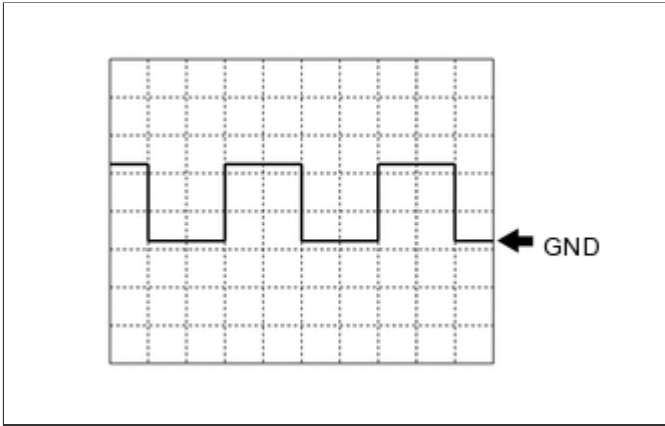
c. Waveform 3 (crankshaft position sensor signal)

| Item | Content |
|-------------------|-----------------------------|
| Terminal | C33-17 (NE) - C33-24 (GND1) |
| Equipment Setting | 5 V/DIV., 20 ms./DIV. |

| Item | Content |
|-----------|---|
| Condition | Power switch on (READY), engine running |

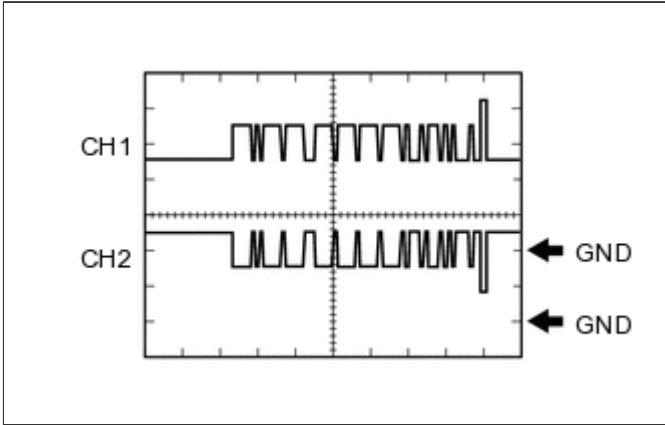
Tip

The wavelength becomes shorter as the engine speed increases.



d. Waveform 4 (communication signal)

| Item | Content |
|-------------------|--|
| Terminal | CH1: C33-19 (HMCL) - C33-24 (GND1) CH2: C33-20 (HMCH) - C33-24 (GND1) |
| Equipment Setting | 1 V/DIV., 50 μ s./DIV. |
| Condition | Power switch on (IG) |

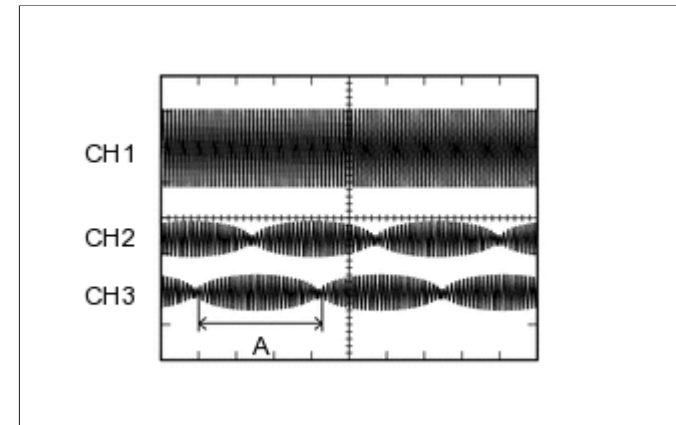


Tip

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

e. Waveform 5 (motor resolver signal)

| Item | Content |
|-------------------|---|
| Terminal | CH1: C32-5 (MRF) - C32-6 (MRFG) CH2: C32-1 (MSN) - C32-2 (MSNG) CH3: C32-4 (MCS) - C32-3 (MCSG) |
| Equipment Setting | CH1: 10 V/DIV., 1 ms./DIV. CH2: 5 V/DIV., 1 ms./DIV. CH3: 5 V/DIV., 1 ms./DIV. |
| Condition | Motor resolver running |



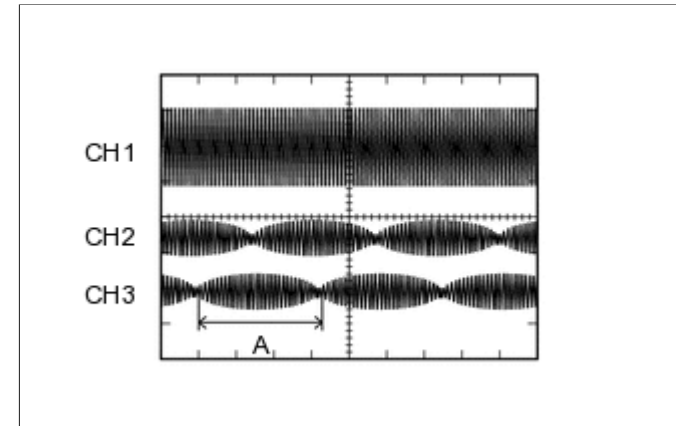
Tip

The width indicated by (A) becomes shorter as the rotor speed increases.

f. Waveform 6 (generator resolver signal)

| Item | Content |
|----------|--------------------------|
| Terminal | CH1: C32-8 (GRF) - C32-9 |

| Item | Content |
|-------------------|--|
| | (GRFG) CH2: C32-10 (GSN) - C32-11 (GSNG) CH3: C32-13 (GCS) - C32-12 (GCSG) |
| Equipment Setting | CH1: 10 V/DIV., 1 ms./DIV. CH2: 5 V/DIV., 1 ms./DIV. CH3: 5 V/DIV., 1 ms./DIV. |
| Condition | Generator resolver running |



Tip

The width indicated by (A) becomes shorter as the rotor speed increases.