

Mitsubishi Turbine: Hybrid™ XT Control Sensor Retrofit

NIPPON ANEMOMETER TO HYBRID XT ANEMOMETER RETROFIT KIT, MITSUBISHI, NEI (9370)
NIPPON YAW VANE TO HYBRID XT VANE RETROFIT KIT, MITSUBISHI, NEI (9371)

Introduction

Instructions for replacing original Nippon Electric Inc (NEI) wind vane and anemometer on Mitsubishi turbines with Hybrid XT Sensors (XTs) are provided below. Users should be familiar with the operation of the Hybrid XT vane and anemometer prior to performing this retrofit.

RNRG mount converters adapt the NEI sensor flange mounts to the RNRG XT mount with captive connectors and cable.

The RNRG sensor cables connect to the same junction box connections as the NEI sensors, with minor changes.

To provide the increased heating capability for the XTs, a power supply is added to the control cabinet, fed from the same AC supply that formerly supplied the NEI bearing heaters. The supply is fed to the new sensors using the existing cabling.

The XT sensor power and signal wiring uses the existing NEI sensor cabling to the control cabinet. The controller connections are modified to connect the XTs signal directly to the controller.

Users should be familiar with the operation of the Hybrid XT anemometer and vane prior to performing this retrofit.

Product manuals and instructions for retrofits on other turbines can be obtained by contacting Renewable NRG Systems at info@rnrgsystems.com.

NOTICE

Always power the heater on your Hybrid XT sensor! Failure to maintain constant heating may lead to corrosion or inferior sensor performance. Constant heating prevents condensation from forming on the bearings, enabling the sensor to achieve a 10 year service cycle. **If the sensor is used without the heater, the warranty will be void.**



WARNING

This procedure requires:

- **Access to nominal 220V AC mains power**
- **Access to sensor mast**

This procedure should only be performed by qualified personnel, in accordance with onsite safety protocols.



WARNING

Sensor surfaces (particularly the head and the upper body) can become quite hot and may burn you; especially in warm ambient conditions. ***Use caution when the heater power is on.***

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Tools required

- 1) 10mm socket and ratchet. Torque wrench is recommended.
- 2) Wire strippers for 22 – 14 AWG wire
- 3) Crimp tool for ferrules for 22 – 14 AWG wires
- 4) Crimp tool for lugs on 18 – 14 AWG wires

Kit contents

9370 Hybrid XT Anemometer Retrofit Kit | Mitsubishi | NEI

- 10021 – Mounting adaptor for Mitsubishi
- 9234 – Assembly-Cable,300V,10m,Connector,Power,Signal,WithMountingBolt
- 9365 - Hybrid XT Anemometer, 4-20mA Output, 60 m/s

9371 Hybrid XT Vane Retrofit Kit | Mitsubishi | NEI

- 10021 – Mounting adaptor for Mitsubishi
- 9234 – Assembly-Cable,300V,10m,Connector,Power,Signal,WithMountingBolt
- 9362 -- Hybrid XT Vane, 4-20mA Output, CCW

9376 Hybrid XT Heater Power Kit | Mitsubishi Turbines

- Wiring Kit
- Heater Power Supply

Procedure

Wire power for sensor heaters

Heater power for the XTs is provided by a power supply added to the control cabinet.

The power supply unit (PSU) and heater fuses will be mounted to the available DIN rail space in the upper control cabinet, next to transformer AC/DC-51. For best access, connect the wiring to the components before attaching them to the rail.

Open the control cabinet. For best access, remove the door grounding straps and remove the cabinet doors.

1) Open breaker BL54. LOTO the breaker.

Remove the existing wires U45 and W45 from the load side (bottom) of BL54. Cap the wires with wire nuts and tuck them out of the way.

2) Connect the AC feed from BL54 to the PSU.

Wire	From	To	Notes
18 AWG Red	BL54 Load Side Line (lower Left)	Power Supply, Input "L"(bottom terminals)	Route through wiring channel
18 AWG White	BL54 Load Side Neutral (lower right)	Power Supply, Input "N"(bottom terminals)	Route through wiring channel

3) Secondary wiring for heater power

- a. Connect short jumper wires from the two PSU "+" output terminals to the two sensor heater fuses. Use crimp ferrules on these connections.

Wire	From	To	Notes
18 AWG Red Approx. 6"	PSU Output "+" terminal	First Fuse Block, bottom (hinge) end	Wire approx. 6" long
18 AWG Red Approx. 6"	PSU Output "+" terminal	First Fuse Block, bottom (hinge) end	Wire approx. 6" long

- b. Disconnect the existing wires "U45" from TB-11 terminal 49 and 51 (White wires, red terminals).
- c. Disconnect the existing wires "W45" from TB-11 terminal 50 and 52 (White wires, black terminals). Cap the removed wires with wire nuts and tuck them out of the way. Do NOT change the existing connections to cables C-70 and C-72 (Black/White 2 conductor cables).

- d. Connect the new heater power to these existing heater cables which feed to the sensor junction box. Use crimp ferrules on these connections, except use a "fork" terminal to connect to the frame ground screw.

From	Wire	To	Notes
First Fuse Block, Top end	18 AWG Red	TB-11, terminal 50	Wind Vane Heater Power
Second Fuse Block, Top end	18 AWG Red	TB-11, terminal 52	Anemometer Heater Power
PSU Output "-" terminal	18 AWG Black	TB-11, terminal 49	
PSU Output "-" terminal	18 AWG Black	TB-11, terminal 51	These two wires are stacked together in one of the PSU output "-" terminals
PSU Output "-" terminal	18 AWG Green	Frame ground, see note below	

Note: The – side of the heater power supply is grounded to frame ground. The easiest frame ground point to access is to stack this connection with the existing frame ground screw at the left side of the panel divider shelf. Add the new terminal to the screw; leave the existing (white) wire connected as well.

4) Mount the heater power supply parts

- a. Working left to right, latch the two heater fuse blocks onto the rail next to transformer AC/DC-51, then latch the PSU onto the rail. The finished installation will look similar to this photo. The exact type of PSU may vary.



Sensors and mounting

1) Remove NEI sensors and cables

- a. Open the wind sensor junction box
- b. Disconnect the cables to the two wind sensors from the junction box
- c. Remove the existing wind sensors from the mounting flanges

2) Install mount converters

- a. Install the XT mount converters to the sensor flanges, using the same process as for replacing an NEI sensors. The anemometer and wind vane converters are the same
- b. Apply sealant to the flanges as normal for a sensor replacements
- c. Re-connect the grounding lugs as they were before. The completed conversion will look similar to this photo.



3) Trim, label and install new cables

- a. Cut each XT cable to approx. 15 feet long
- b. Label one cable at each end with the provided "Anem" labels and the other with the provided "Vane" labels
- c. Prep the shield braid at the connector with a #10 ring lug
- d. Remove the bolt and washer and flag nut from the Vane cable, thread the cable down through the converted Vane boom (on the right side of the machine, facing the rotor)

Important: Orient the connector with its notch, and the "Toward Rotor" label turned toward the rotor. Note the "Toward Rotor" label in this photo:



- e. Install the bolt and washer from the front side, and put the nut plate in place on the back side, finger tight.
- f. Repeat this installation for the Anemometer cable on the left side of the machine.

Install XT sensors

- 1) Install the Model 9362 XT Vane (4 ~ 20mA, Counter-Clockwise) on the right side mast, labelled. Observe the "Toward Rotor" label to orient the sensor correctly "Vane"
- 2) Plug the sensor onto the mount
 - a. The nut plate slides into the notch on front side the sensor, with the washer and bolt head on the back side of the sensor toward you
- 3) Tighten the mounting bolt to 27 in-lbs torque (10 mm wrench)
- 4) Repeat this process to install the Model 9365 XT Anemometer (4 ~ 20mA, 0 ~ 60 m/s) on the left side mast, labelled "Anem"

Update TVS for anemometer

- 1) In the wind sensor junction box, remove the two MOV surge protectors (Black disc shaped components) from the junction box terminals 1 and 2, which are connected together at terminal 3
- 2) Install the supplied TVS Diode surge protectors to terminals 1 and 2 with the common leads to terminal 3, replacing the MOVs

Prep and connect new sensor cable connections

- 1) Thread the new cables though the cable grommets into the wind sensor junction box
- 2) Strip the cable jackets and prep each wire except the yellow wires with a “fork” terminal

NOTE: The yellow wires are not used

- 3) Prep the cable shield with a large “fork” terminal

Connect the wires as shown in the tables:

Table 1 Hybrid XT sensor wiring tables

Anemometer Cable	Function	Wind Sensor Junction Box	Notes
Black Wire	Signal Ground	terminal 1	
White Wire	Signal	terminal 2	Wind speed signal
Red Wire	Sensor +24 V power	terminal 7	with Red wire from Vane.
Yellow Wire	Not used	Not connected	Trim, and or coil out of the way
Orange with Black Stripe	Heater +	terminal 13	Heater Power +24 V
Orange with White Stripe	Heater -	terminal 12	Heater Power ground
Cable Shield Braid	Shield	terminal 4	Shield Ground, Earth ground

Vane Cable	Function	Wind Sensor Junction Box	Notes
Black Wire	Signal Ground	terminal 5	
White Wire	Signal	terminal 6	Wind direction signal
Red Wire	Sensor +24 V power	terminal 7	with Red wire from Anemometer.
Yellow Wire	Not used	Not connected	Trim, and or coil out of the way
Orange with Black Stripe	Heater +	terminal 11	Heater Power +24 V
Orange with White Stripe	Heater -	terminal 10	Heater Power ground
Cable Shield Braid	Shield	terminal 9	Shield Ground, Earth ground

Control signal retrofit

1) Remove 4-20 mA converters

- a. In the control cabinet, unlatch and remove the K-Unit signal conditioners at MMMX-106D and MMMX-106S. These two units are no longer needed.
- b. Temporarily unlatch and remove the K-Unit signal conditioner at MMMX-103. This unit is removed to gain access to the wiring behind it and will be replaced later

2) Remove old sensor signal wiring

- a. In the control cabinet, disconnect the following wires from the back row of TB-10. Cap each wire with a wire nut and tuck it out of the way.
 - i. Remove wire 106D/1 from TB-10 53
 - ii. Remove wire 106D/2 from TB-10 54
 - iii. Remove wire 106D/3 from TB-10 55
 - iv. Remove wire 106S/1 from TB-10 71
 - v. Remove wire 106S/2 from TB-10 72
- b. Disconnect the following wires from CNTB-13. Cap each wire with a wire nut and tuck it out of the way.
 - i. Remove wire NA/01+ from CNTB-13 1
 - ii. Remove wire NA/01- from CNTB-13 2
 - iii. Remove wire NAI/04+ from CNTB-13 13
 - iv. Remove wire NAI/04- from CNTB-13 14

3) Connect new sensor signal wiring

- a. In the control cabinet, add the following connections. Use crimp Ferrules for connections to TB-10 and CNTB-13. Use fork terminals to connect to the screw terminals on the empty socket for MMX-106 S.

From	Wire	To	Notes
TB-10 terminal 71	22 AWG Black	TB-10, terminal 53	Two wires connect to TB-10 terminal 53. Put both wires into one ferrule for ease of connection.
socket for MMX-106 S, screw terminal 8	22 AWG Black		
socket for MMX-106 S, screw terminal 8	22 AWG Black	CNTB-13, terminal 2	Two wires connect CNTB-13, terminal 2. Put both wires into one ferrule for ease of connection.
CNTB-13 terminal 14	22 AWG Black		
socket for MMX-106 S, screw terminal 7	22 AWG Red	TB-10, terminal 53	
TB-10, terminal 54	22 AWG White	CNTB-13, terminal 1	
TB-10, terminal 72	22 AWG White	CNTB-13, terminal 13	

4) Reinstall yaw position converter MMMX-103 into its socket and latch it in place

5) Test heater power

- a. Follow site specific procedures to Un-tag Breaker BL-54
- b. Open both heater fuse blocks by hinging the fuse carriers open
- c. Turn on Breaker BL-54. The "DC OK" LED on the PSU should light.
- d. Insert the fuses for sensor heat by closing the fuse blocks. The "DC OK" LED on the PSU should stay on.
- e. At the wind sensor junction box, measure DC voltage from terminal 11 (+) to 10 (-). Voltage should be approximately 24 V DC.
- f. At the wind sensor junction box, measure DC voltage from terminal 13 (+) to 12 (-). Voltage should be approximately 24 V DC.

6) Test anemometer signal

- a. At the wind sensor junction box, measure DC voltage from terminal 7(+) to 1(-). Voltage should be approximately 24 V DC.
- b. Using the local terminal connection, verify the correct wind speed is displayed. (If the wind is very low during this procedure, spin the anemometer by hand to verify that wind speed data is read by the controller).

7) Verify yaw position signal

- a. Using the local terminal connection, verify that the nacelle angle is correctly displayed.

8) Test vane signal

- a. At the wind sensor junction box, measure DC voltage from terminal 7(+) to 5(-). Voltage should be approximately 24 V DC.
- b. Using the local terminal connection, verify the correct wind direction is displayed. Use the nacelle angle and the reported wind direction to verify that the vane is read correctly by the controller. If possible, move the vane by hand to verify that the wind direction data is read by the controller.

9) Close out

- a. Replace the cover on the wind sensor junction box
- b. Route the two sensor cables to provide drip and service loops
- c. Replace the doors on the control cabinet, reconnect the door grounding straps
- d. Secure the control cabinet

System startup

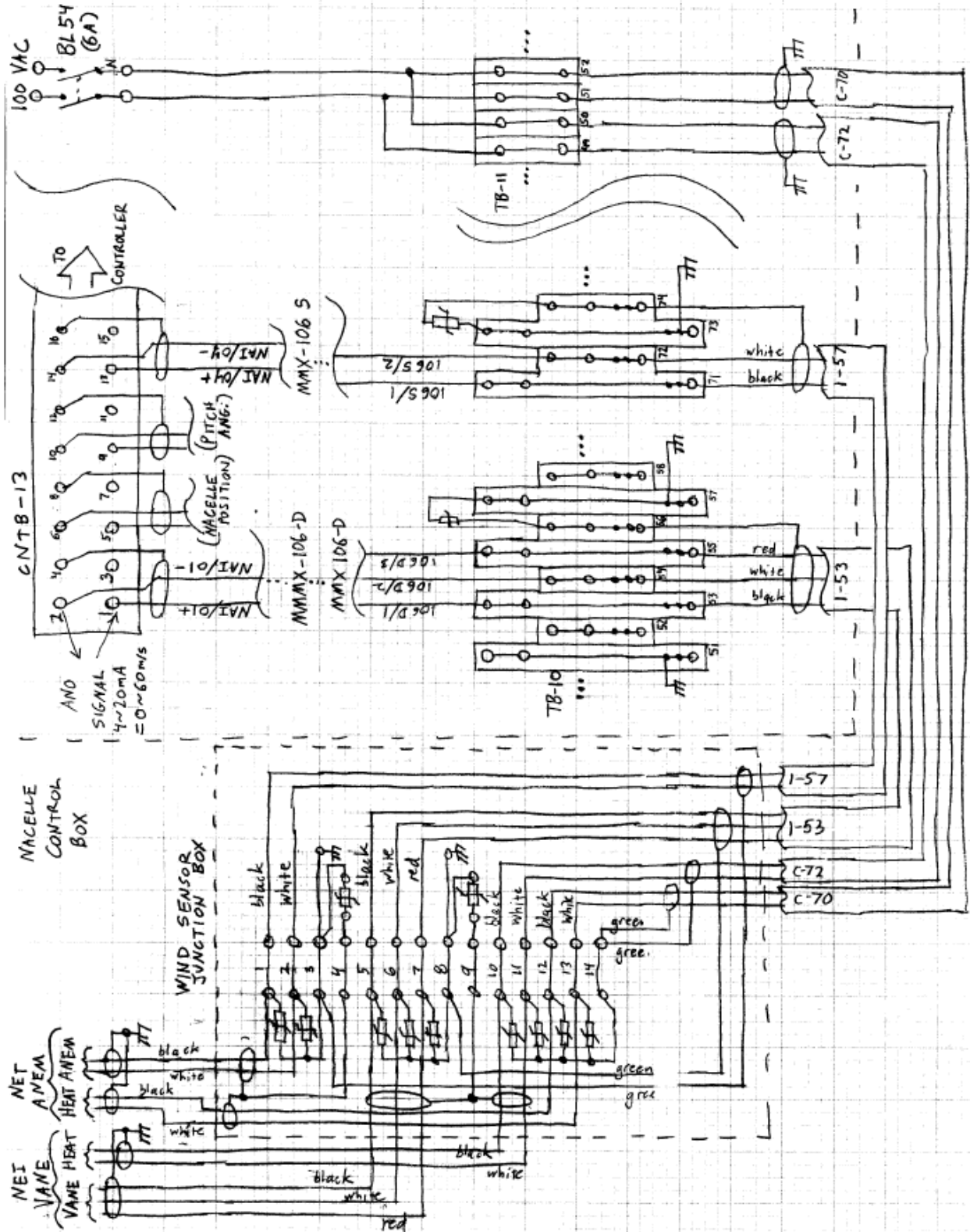
1) Verify Startup and Yaw

- a. After exiting the turbine, start the turbine as usual
- b. Verify that the turbine yaws in the correct direction into the wind
- c. Compare the turbine direction to the neighboring machines
- d. Verify that the turbine starts and reconnects to the grid without errors

2) Verify Anemometer scaling and Wind Speed in SCADA

Reference wiring diagrams

Before retrofit



After retrofit

