

CONSTRUCTION GUIDELINE

**HAZELTINE MODEL 2391 TRANSMITTER INSTALLATION
 TYPE "O1"**

NOT FOR NEW CONSTRUCTION – FOR MAINTENANCE ONLY

1. HAZELTINE EQUIPMENT DESCRIPTION: The original Hazeltine transmitter (Model 2391) is known within Seattle City Light as a Type "O1" transmitter. The transmission frequency is selected by use of a program card in conjunction with the frequency select plug. The ID Number is selected by cutting traces on the program board.

1.1 TRANSMITTER:

The transmitter provides status information for five switches or contacts and three load current inputs. This status is transmitted by coded power line carrier signals over the network feeders to the substation receiver. Unique identification and frequency selection for each transmitter is provided by the plug-in program board and the power plug. Data for the load current is from current transformers (CT's) installed on the network protector's main current transformer secondary leads. The unit, when properly connected to the interface cable, is submersible.

1.2 CURRENT TRANSFORMER ASSEMBLY (CT'S):

The Hazeltine Model 2358 CT is used to monitor the load currents on each phase of the network transformer from inside the transformer's network protector. The Hazeltine Model 2358 CT is installed on the leads from the main network protector CT's. The Model 2358 is internally protected for open circuits under load.

1.3 PROGRAM BOARDS:

The coding of the transmitter for both identification (ID No.) and frequency selection is controlled by the program board. The board is available in one of four colors for ease of frequency identification.

1.3.1 Frequency selection is by site survey from the manufacturer and one frequency is assigned to all transformers on that feeder. Network Engineering maintains the current frequency that is assigned to each feeder and it will be included on the installation drawing. The available frequencies are as follows:

Color	Transmission Frequency kHz	Jumper No. (Deleted or Cut)	Stock No.	Cancelled Stock No.
Red	45 kHz	3 and 4	687745	–
Blue	50 kHz	3 and 11	687750	–
Green	55 kHz	3, 4, and 11	obsolete*	687755
Yellow	62 kHz	15	687762	–

* No stock, Stock Number cancelled.

1.3.2 The ID number is assigned by Network Engineering and will be included on the transformer installation drawing. To select an ID number, cut multiple jumpers and add respective ID numbers.

ID No.	Jumper No. (Deleted or Cut)
1	10
2	2
4	9
8	1
16	7
32	14
64	6
128	13
256	12
512	5

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1.3.3 Example: For 55 kHz use green program board and cut jumpers 3, 4, and 11. To obtain ID No. 234, cut jumpers 1, 2, 6, 13, and 14 (128 + 64 + 32 + 8 + 2 = 234).

1.4 INTERFACE CABLE:

The interface cable assembly is supplied with two connectors and a rubber boot molded onto one end, three sealed two-wire rubber-covered cables, and a cable with a pressure seal containing loose wires at the opposite end. The rubber boot end is attached to the monitor transmitter. The three sealed two-wire rubber-covered cables are attached to switches outside the network protector as directed on the transformer installation drawing. The cable with the pressure seal containing loose wires is routed through the network protector case and attached inside the network protector (see Figure 2).

2. HAZELTINE EQUIPMENT INSTALLATION

2.1 TRANSMITTER:

Two transmitter mounting straps are provided. Clamp the transmitter to the support rack (Stock No. 687725) using the two mounting straps. Locate the mounting straps 10 inches apart.

2.2 CURRENT TRANSFORMERS (Three Required):

Install the Hazeltine Model 2358 CT on the non-polarized side of each phase of the network protector relaying CT's ("X" side).

2.3 PROGRAM BOARD AND INTERFACE CABLE

2.3.1 Connect the transmitter to the program board and the interface cable. The rubber boot end of the interface cable is attached to the transmitter by connecting the electrical plugs per Figure 2 and in the following order:

- A. Connect the digital plug to the digital receptacle.
- B. Plug in the program board (Item 5). See paragraph 1.3 for frequency and ID number assignments.
- C. Connect the frequency select plug to the back of the frequency select receptacle. This plug is to be installed to either P1, P2, P3, or P4 (green, blue, red, or yellow receptacle) as identified by the color of the program board.
- D. Install the frequency select receptacle to the back of the transmitter until it locks into place.
- E. Slide the boot down over the transmitter housing as far as possible. Slide the hose clamp up over the boot and locate it squarely on the transmitter housing (no sideways twist). Tighten the hose clamp securely and mount the transmitter with the straps in the mounting brackets.
- F. Near the connector and boot end, three two-wire rubber-covered cables "break out" and can be routed separately to switch sensors located on the exterior of the transformer. Use switch terminals that are normally open (closed on detected abnormal condition) and seal the connections to make them waterproof. The three cables have color-coded sleeves and are used as follows:

Color	Flag Assignment	Connected to:
Orange	"C" Sensor	Thermometer on transformer
Yellow.....	"D" Sensor	Unused
Green	"E" Sensor	Oil level gage on transformer

- G. If the transformer has a dial-type thermometer with alarm contacts, connect leads from the Hazeltine's orange cable to the alarm contacts. Seal the connections to make them waterproof.
- H. If the transformer has a dial-type oil level gage with alarm contacts, connect leads from the Hazeltine's green cable to the alarm contacts. Seal the connections to make them waterproof.

2.3.2 Connect the interface cable to the network protector per Figure 1 and the following instructions:

- A. On all pre-1960 Westinghouse network protectors, installation of a microswitch, mounted on the left-hand arc-shoot barriers, is required to obtain a non-used switch position for brown and green wires (see Figure 1).
- B. Installation of an autotransformer is required when converting from 277/480V to 120/208V. The autotransformer is connected between the network side Phase 2 and the ground (see Figure 3).
- C. The loose wires must be passed through an opening in the network protector casing tapped for a 1/2-inch NPT so that the seal is maintained properly. The 12 color-coded wires entering the network protector are connected as follows (see Figure 1):

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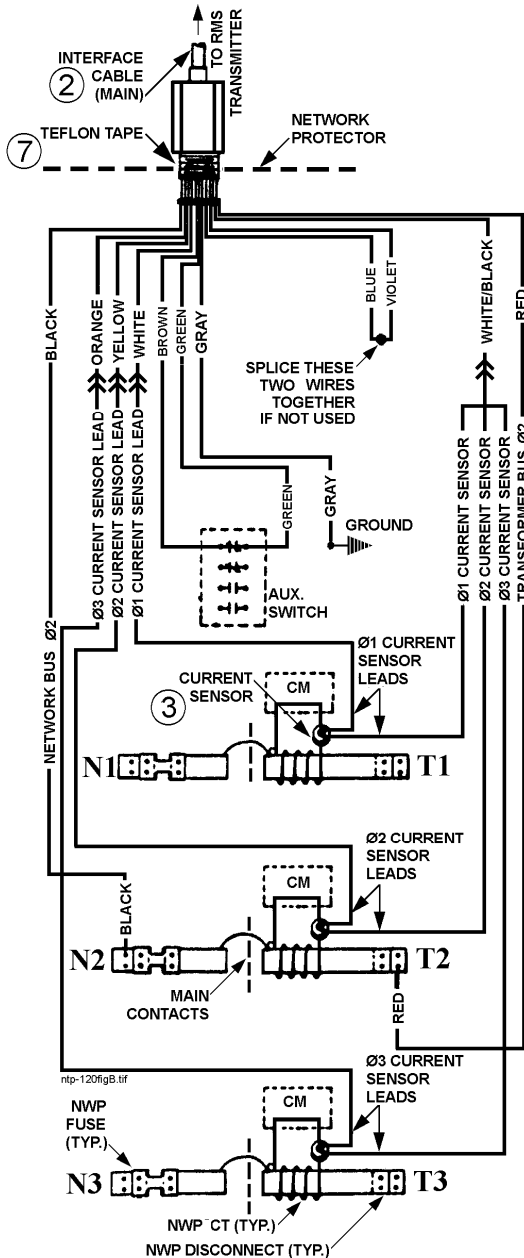


FIGURE 1

Some of the Color-Coded Wire Connections

- RED** Connect as directly as possible to the Phase 2 bus on the transformer side (not the network side) of the network protector (120V or 277V).
- BLACK** Connect as directly as possible to the Phase 2 bus on the network side of the network protector (120V nominal). On 277/480V applications, connect to terminal No. 2 or black lead of the autotransformer (see Figure 3).
- GRAY** Connect solidly to a good ground. On 277/480V applications, connect to terminal No. 3 or gray lead of the autotransformer and to a good ground (see Figure 3).
- WHITE** Splice and carefully tape this wire to one of the wires extending from the current transformer assembly for Phase 1.
- YELLOW** Same as above for Phase 2.
- ORANGE** Same as above for Phase 3.
- WHITE/ BLACK** Splice and carefully tape the remaining wire from each of the load current sensor assemblies to this wire.
- BLUE & VIOLET** These two wires must be shorted together and taped securely. This is an unused condition and if not shorted, will cause report flag "A".
- BROWN & GREEN** Connect these wires to unused auxiliary contacts on the network protector circuit breaker (either color to either connection). The connection to the auxiliary contacts must be such that the contacts are open when the network protector is closed, and closed when the network protector is open. For pre-1960 Westinghouse, use the microswitch installed in paragraph 2.3.2.a. This will cause report flag "B" when the protector is open.

MATERIAL LIST

Item No.	Quantity	Description	Stock No.	Cancelled Stock No.
2	1 each	Interface Cable (Main)	obsolete*	687715
3	3 each	Load Current Sensor, CT	687720	-
7	1 roll	Teflon Tape	736690	-

* No stock, Stock Number cancelled.

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TEST EQUIPMENT:

After the interface cable has been installed, it should be checked with a cable installation tester.

HAZELTINE MATERIAL LIST

Item	Quantity	Description	Stock No.	Cancelled Stock No.
1	1 each	Transmitter, Remote, Model 2391, type "O1"	obsolete*	687710
2	1 each	Interface Cable	obsolete*	687715
3	3 each	Load Current Sensor, CT	687720	-
4	1 each	Support Rack	687725	-
5	1 each	Program Board - Use one of the four available:		
		Red 45 kHz Transmission Frequency	687745	-
		Blue 50 kHz Transmission Frequency	687750	-
		Green 55 kHz Transmission Frequency	obsolete*	687755
		Yellow 62 kHz Transmission Frequency	687762	-
6	1 each	Autotransformer, for 480V Transformers	687730	-
7	1 roll	Teflon Tape	736690	-

* No stock, Stock Number cancelled.

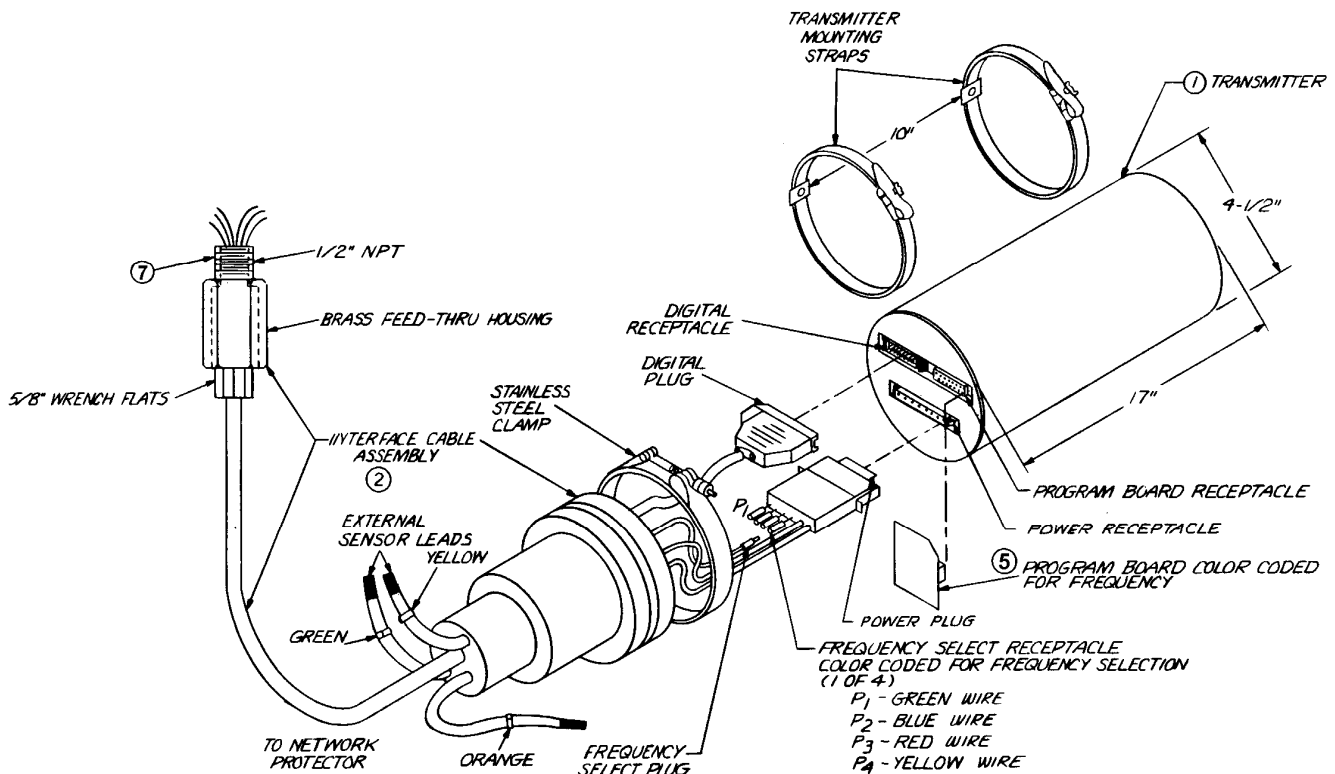


FIGURE 2

Transmitter, Program Board, and Interface Cable Assembly

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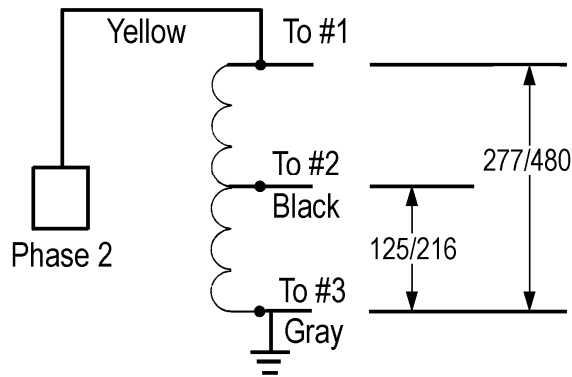


FIGURE 3
 Autotransformer Wire Connection
 (Required for 480/277V Applications)

Item	Quantity	Description	Stock No.
6	1 each	Autotransformer, for 480V Transformers	687730