Addendum to IL H-41-1000

## RVC Speed Matcher

## For use on 50 Cycle

Operation of the RVC is explained with reference to 60 cycles, and all telephone relay times are given in cycles on a 60 cycle basis. Operation of 50 cycle relays is similar to operation of 60 cycle relay.

Adjustment of Directional and SV Elements (Pages 5 & 6) are to be made at nameplate frequency.

### Telephone Relay Times

| | |
|---|---|
| Relays R & L | 9 milliseconds maximum operate delay |
| Relay Y | 25 milliseconds minimum operate delay |
| Relay X | 25 milliseconds maximum operate delay |
| | 165 to 185 milliseconds release delay. |

Dated 6/10/64

Canadian Westinghouse Company Limited
Switchgear and Control Division
Hamilton, Ontario

INSTALLATION • OPERATION • MAINTENANCE

# INSTRUCTIONS

## TYPE RVC SPEED MATCHER
## IN FT-31 OR M-10 FLEXITEST CASE

CAUTION - Before placing relay in service remove all blocking.

### CONSTRUCTION

The RVC relay is made up of 6 basic elements.

2 - High Speed telephone relays (R and L)
1 - Slow pick up telephone type relay (Y)
1 - Slow drop out telephone type relay (X)
1 - Type SV over voltage relay
1 - Single loop directional element
2 - Neon lamp assemblies

### OPERATION

The relay determines whether the incoming voltage lags or leads the bus voltage when the two voltages are 90° apart.

Referring to Figure 1, the voltage of the bus is assumed to be fixed, while the voltage of the incoming machine will rotate clockwise if the incoming machine frequency is too low, or counter-clockwise if the incoming machine frequency is too high.

The directional element has zero torque when the incoming and bus voltages are in phase, and contact DL (Right Hand) is closed when the incoming voltage lags the bus voltage by any angle between 0 and 180 degrees. Conversely DR is closed when the incoming voltage leads by any angle between 0 and 180 degrees.

The SV element is adjusted to be operated when the incoming voltage lags by 90° to 270°, and reset when the incoming voltage leads or lags by 90° or less.

Assuming now that the incoming machine is running slow, and that at the beginning of a slip cycle both voltages are equal and lie along the line OA, the operation through a complete slip cycle is as follows.

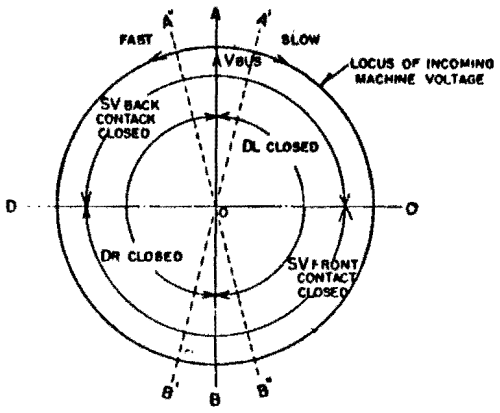
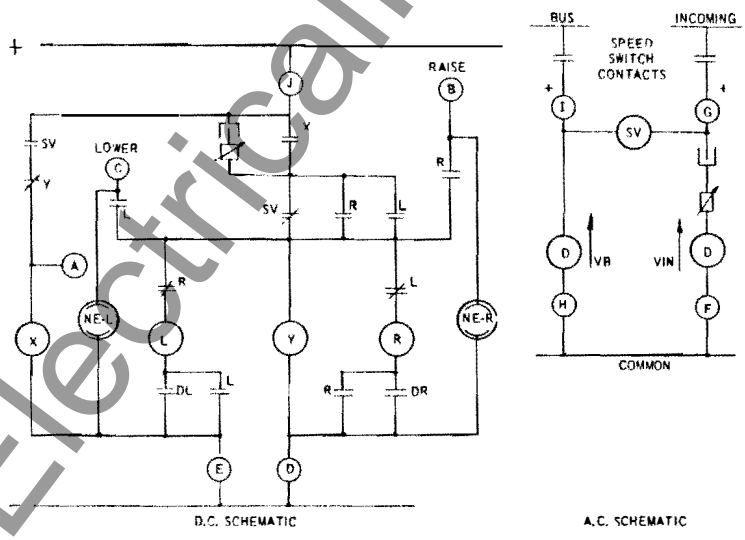



FIGURE 1 - BASIC VECTOR DIAGRAM

Starting off with both voltages along OA, the directional element produces zero torque, and the voltage on the SV is zero. The incoming machine voltage rotates clockwise and closes DL. When the incoming machine voltage lies along the line OC the SV element is picked up and energizes the X relay.

When the incoming machine voltage lies along the line OB, the directional element torque is zero again, and, as the incoming voltage progresses farther clockwise, DR is closed.




| LINE | | A | B | C | D | E | F | G | H | I | J | REF. SCHEMATIC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M-10 F.T. CASE TERMINALS | 1 | 3 | 4 | 7 | 8 | 13 | 14 | 15 | 16 | 2 | 306A731 |
| 2 | FT-31 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 307A055 |

FIGURE 2 - EXTERNAL SCHEMATIC DRAWING #306-A-732

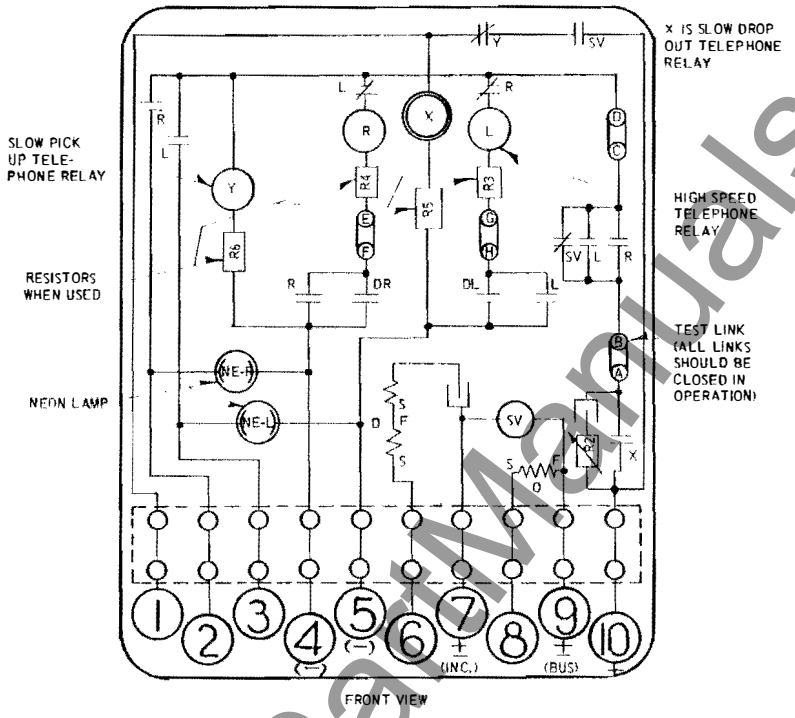



FIGURE 3 - INTERNAL SCHEMATIC - FT 31 CASE
DRAWING #307-A-055

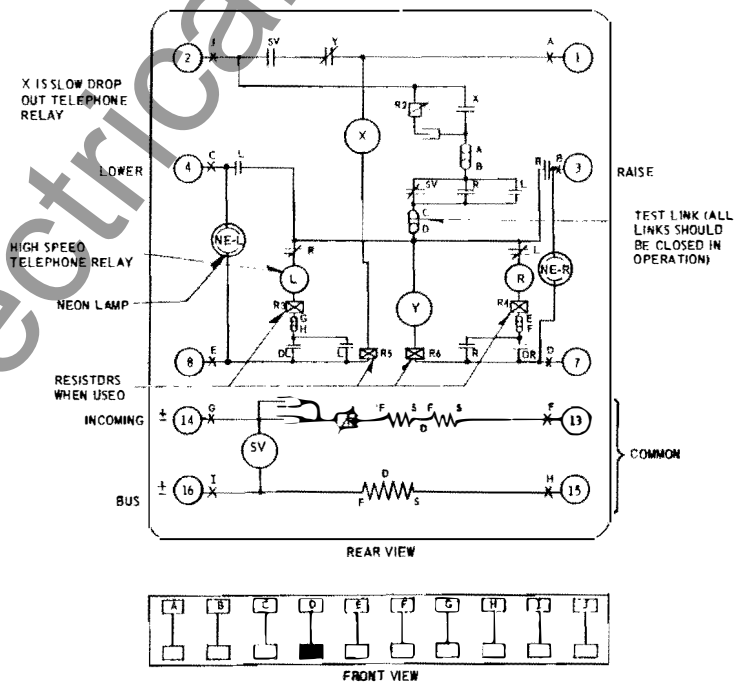



FIGURE 4 - INTERNAL SCHEMATIC - M10 CASE
DRAWING #306-A-731

When the incoming machine voltage lies along the line OD, the SV element drop out voltage is reached, the SV relay resets, and the telephone relay X is de-energized. However, the X relay contact remains closed for the length of its drop out time setting and a circuit to the "raise" control terminal of the governor motor is completed. The relay R also seals in contact DR and blocks contact DL. The "raise" Neon lamp is also energized. The "raise" signal will be given until relay X has dropped out. This blocking of DL is necessary because when the incoming generator voltage again passes the line OA, the contact DL would close thus sending out an incorrect "Lower" signal. The relay R must therefore be fast enough to seal in contact DR and block contact DL in the 90° interval between OD and OA. The X relay must pickup in the 180° interval CBD. Based on a 10 cycle drop out time of relay X, the speed matcher will give a 10 cycle (60 cycle basis) raise impulse each slip cycle for slip frequencies of 3 cycles or less.

For higher slip frequencies, the back contacts of the SV relay would interrupt the signal each slip cycle, and provide too short a signal. For this reason, the back contact of the SV unit is sealed in by a contact of relay R, and relay Y has been added to maintain the pulsing action of relay X. Relay Y is energized each time contacts X and SV back contacts close. After a time delay of approximately 1.5 cycles, relay Y opens and opens the coil circuit of relay X. After a time delay of 10 cycles relay X opens and interrupts the raise impulse.

For incoming machine speeds higher than bus speed, the operation is similar except that "Lower" signals are given, and relay L blocks the DR contacts.

## Effect of Frequency on Directional Operation

The characteristic of zero directional torque when the running and incoming voltages are in phase or 180° out of phase is accomplished by the use of series capacitor in one of the directional potential circuits. When a frequency lower than 60 cycles is applied to this circuit, the effect is to rotate the zero torque line AB toward the dotted position A'B' of Figure 1. This gives relay R slightly more time to operate and thus is an advantage. A frequency higher than 60 cycles rotates the directional zero torque line towards the dotted position A"B". This provides more time for relay L to operate and again is a slight advantage.

## Frequency Range

The RVC operates correctly for incoming machine frequencies within 10% of the running machine frequency.

Loss of Incoming or Running Machine Voltage

With only one voltage applied to the speed matcher, no signals will be given.

RVC RELAY - ADJUSTMENTS

Relays R and L: (Westinghouse Style No. 391B400HO1)

The R and L relays should close their make contacts in 1/2 cycle (60 cycle basis) or less when energized at 80% of rated D.C. voltage.

Relay Y: (Westinghouse Style No. 391B400HO3)

Relay Y should operate at 80% of rated D.C. voltage and when energized at rated D.C. voltage should operate in 1.5 cycles or more.

Slow Release Relay (X): (Westinghouse Style No. 529C502HO1)

The pick up time at 80% rated voltage should be 1.5 cycles or less.

The drop out time is adjusted at the factory by means of the residual adjusting screw to be 10 to 11 cycles (60 cycle basis).

Directional Element: Refer to External Diagram Figure 2.

Energize the potential coil with no series capacitor (terminals H and I) at 115 volts, rated frequency for 15 minutes and see that with the loop hot there is approximately 0.010" end play.

With the relay mounted in its operating position, adjust the stationary contacts to allow a gap of 0.010" to 0.015" between stationary contacts and the moving element blade. See that when the moving contact blade is parallel with its supporting arm that the stationary contacts on each side are uniformly spaced. Adjust the stop screws which limit loop travel to allow approximately 3/64 inch contact follow in each direction.

Zero directional element torque should occur when V incoming and V running are in phase $\pm$ 10°. Figure 5 outlines a method for checking to see that the directional element meets this condition.

Zero torque should occur when the voltage between terminals H and F is 20 volts or less. If torque of directional element is in the same direction for voltmeter reading of zero and 120, reverse connections to B and C.

3 PHASE SOURCE 120 VOLTS LINE TO LINE

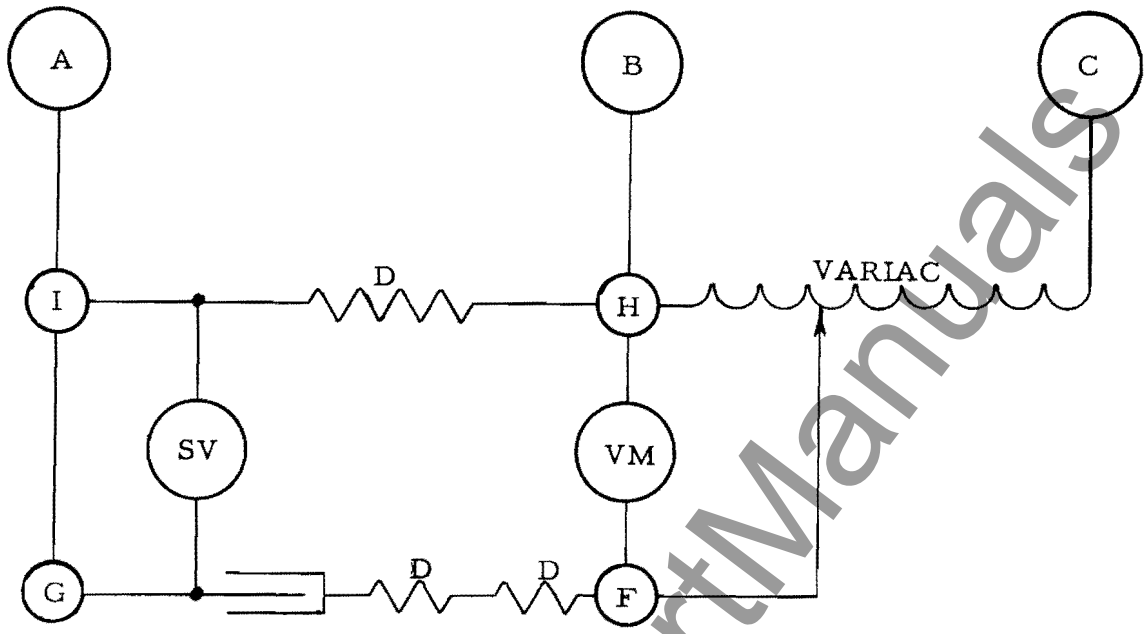



FIGURE 5 - CIRCUIT TO CHECK FOR ZERO DIRECTIONAL ELEMENT TORQUE WHEN V INCOMING AND V RUNNING ARE IN PHASE ± 10°.

The polarity of the directional unit may be checked by connecting the H and F terminals to phase A of 3 phase 115 volt supply, the incoming machine potential terminal (G) to phase B and the bus terminal to phase C. With rotation A, B, C, the incoming machine voltage leads the bus voltage and contact DR should close.

Reversing phases B and C should cause contacts DL to close.

Type SV Element:

The left hand contact spring should, when the plunger is lifted, lie parallel to the backup spring, and to the SV element frame. This left hand contact is adjusted upward until it lifts the SV plunger approximately 1/64 inch. The plunger is then lifted upward until the left hand back contact is just on the verge of opening, and the right hand stationary contact is then adjusted downward until it just touches the corresponding moving contact. The Right and Left contacts should be closed at the same time for no more than 1/64 inch vertical travel of the plunger.

The SV scale is marked to show shunt position for drop out voltages of 140 and 160 volts. The usual setting based on normal machine voltage of 115 volts will be 140 volts. The SV should operate at 110% or less of the voltage at which it is set to drop out.

Contact Capacity:

An adjustable resistor and a capacitor make up an arc suppressing circuit for the X relay contacts. The resistor should be adjusted to the maximum value which will allow the X relay contacts to interrupt the required current without arcing. The X relay contacts can interrupt 2 amperes non inductive at 250 volts D.C. when this resistor is shorted out completely.

The resistor is adjusted in the factory to allow X relay contacts to interrupt 0.5 amperes at 250 volts D.C.

Neon Lamps - The Neon lamp assembly is Westinghouse Style No. 55D8913P7.

The NE-51 Neon bulbs are Westinghouse Style No. 55D8913P8.

Reference Literature

| | |
|---|---|
| SV Relays | I.L. 41-766.1 |
| FT-31 Case | I.L. 41-076 |
| M-10 FT Case | I.L. 41-070.1 |

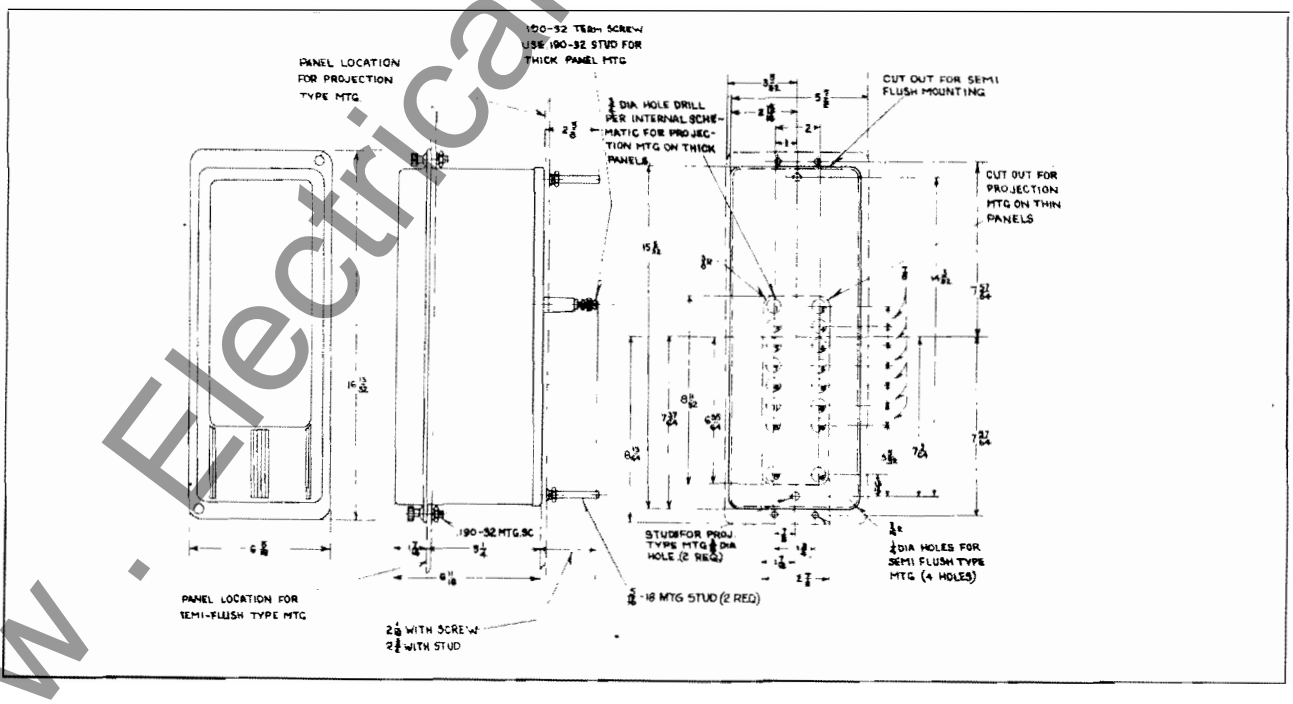



FIGURE 6 - OUTLINE AND DRILLING PLAN FOR THE M10 SEMI-FLUSH (9B-1903) OR PROJECTION (9B-2021) TYPE FT CASE DRAWING #16-B-2477

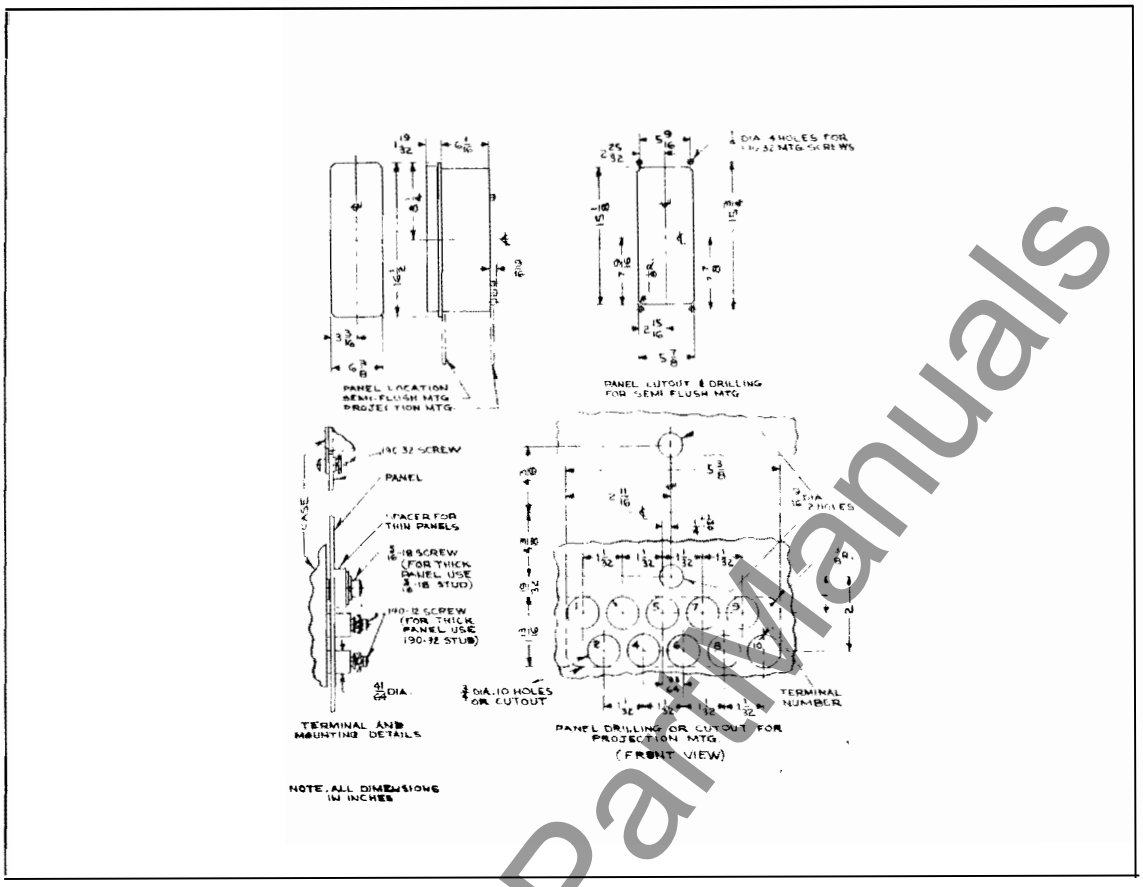



FIGURE 7 - OUTLINE AND DRILLING PLAN FOR THE TYPE FT31 CASE
DRAWING #57-D-7902