Weston ENGINEERING NOTES

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THE NEW MODEL 856 SEALED PHOTOCELL

WESTON PHOTRONIC* Photocells are occasionally required to operate under conditions of high ambient humidity. Normally, where exposure to such conditions is of limited extent and the terminal potential is moderate, no noticeable changes will occur. But if these conditions are continuous, the excessive moisture absorbed by the selenium can cause changes by electrolytic action which are partially permanent and irreversible.

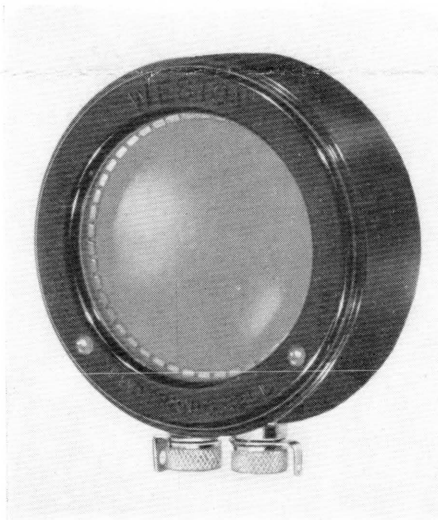

Figure 1—Front view of the Model 594 Type 3 Cell.

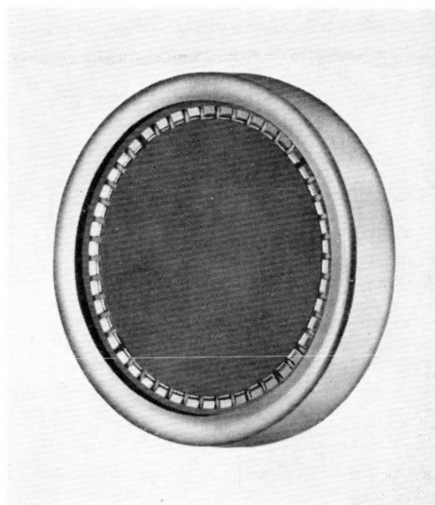

Figure 2—Front view of the Model 856 Sealed Cell.

In the older Model 594 Photocell (see Figure 1), the cell element is coated with a moisture-resistant lacquer to inhibit water penetration, to retard the rate of moisture absorption for periods of time in the order of days. Where the *average* humidity is reasonably low and the periods of high humidity are short in terms of days, the method is effective. But under continued high humidity, sufficient moisture can be absorbed to deteriorate the cell under conditions of high terminal potential caused by high illumination and load resistance.

For operation under these conditions, a new hermetically sealed case has been designed which will be known as the Model 856 Sealed PHOTRONIC* Photocell. The appearance and external dimensions are illustrated in Figures 2 and 3 respectively.

Description

The cover glass is metalized and soldered directly to a one-piece drawn case, which is crimped over the edge of the glass prior to soldering for independent mechanical strength. The terminal leadouts are glass-bead sealed, with the positive terminal at the center of the case and the negative terminal near the circumference. The terminal ends are flattened and pierced for soldering at installation. The case is insulated from the cell circuit, and is tested for 500 volts a-c breakdown.

Two 8-32 threaded studs on one-inch centers are provided for mount-

In This Issue

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ing. The studs are headed over in the case for mechanical strength, and soldered for sealing. The plane

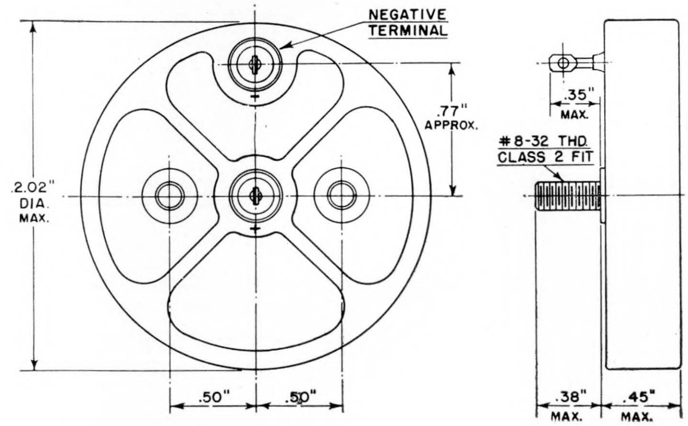

Figure 3—Dimensional diagram of the Model 856 Cell.

of the stud shoulders clears the raised portions of the rear of the case so that the bolt load is entirely on the studs with the case clearing the mounting surface. The photocell may be surface mounted through four holes as suggested in Figure 4.

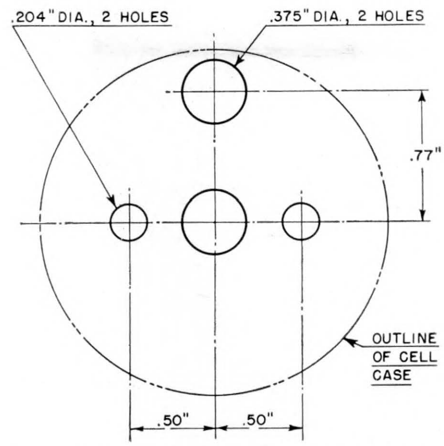

Figure 4—The Model 856 Cell may be surface mounted through four holes as shown above.

The outside of the case is electro-tinned except for the solder surfaces. These are considered corrosion resistant for ordinary atmospheric exposure. If additional protection is required, it is recommended that the cell be dip-coated in, or painted with, a suitable compound. A Glyptol-base paint or compound is suggested. An air-drying material is preferable since the cell should not be subjected to a continued temperature greater than 60 C, with a short period (one minute) maximum of 80 C. Preparatory to dipping, the case may be degreased or lightly sand blasted for adherence.

After assembly, the unit is vacuum dried, and filled with dry helium at approximately atmospheric pressure. In contrast to heavier gases, helium promotes heat exchange between the cell element and the case wall for better cooling when the cell is exposed to considerable total radiation. The internal materials, particularly insulation, are carefully selected to avoid gaseous contamination of the atmosphere with time.

If the cell is mounted on a metal support in a corrosive location, it is recommended that the supporting metal, or its plating, be selected to avoid a high corrosion cell potential against the tin plate on the cell case. It is also suggested that the support be in contact with the photocell case only at the mounting studs, which are relatively heavy and capable of withstanding considerable corrosion.

Angular Acceptance

The acceptance of incident light with respect to the angle of incidence is somewhat closer to the cosine law than the Model 594 because of the smaller case lip at the edge of the window. The relative output as modified by the deviation from the cosine law is shown in Figure 5 for the new Model 856, and for the older Model 594 for comparison.

Radiant Heating

When subjected to illumination containing a considerable amount of total radiation, the case must be cooled to prevent the cell element from exceeding 60 C, the maximum recommended continuous operating temperature. The helium atmosphere is intended to improve the internal heat transfer so that cooling of the case will be as effective as possible.

The thermal conductance between the element and the case is approximately 0.8 watt per degree centigrade temperature difference; i.e., a total incident radiation of 0.8 watt on the cell surface will produce a temperature rise in the element of approximately one degree centigrade above the temperature of the case. The temperature of the case should not be allowed to exceed 60 C less one degree centigrade for each 0.8 watt of incident radiant energy.

Ordinarily the total incident radiation from usual light sources at normal levels is well below that requiring cooling of the cell case, and cooling or heat filtering is only necessary in applications such as optical pyrometers or at high ambient temperatures.

In comparison, the thermal conductance of the Model 856 is considerably better than that of the older Model 594, which is about 0.078 watt per degree centigrade difference.

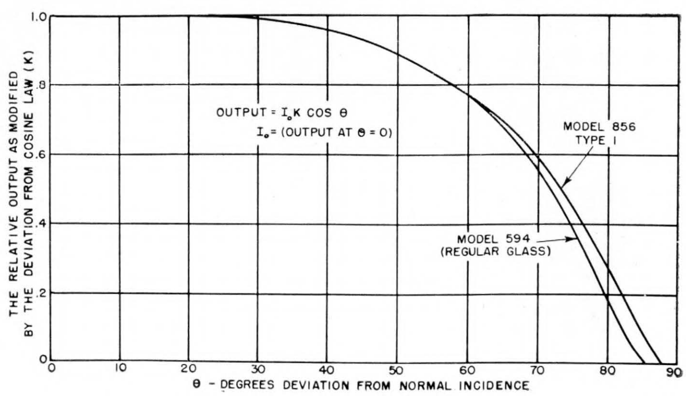

Figure 5—Curve showing relative output of Model 856 in comparison to the Model 594.

Types

The Model 856 Sealed PHOTRONIC* Photocell is at present available in three types, differing in the type of window used, as follows:

Model 856	Window
Type 1	Clear Glass
Type 2	Visual correction filter (VISCOR*)
Type 4	Heat absorbing filter

The Type 4 cell is recommended for applications where the total radiation is excessive for the unfiltered Type 1, but is not sufficient to cause serious heating of the filter proper. In such cases the filter should be external. Generally whenever the radiation will cause a temperature rise in the filter greater than 30 degrees centigrade, a Type 1 Photocell with an external filter is recommended.

For details regarding these filters, and general information concerning the Weston Photocell, refer to Technical Data Bulletin B-21-D, which is available upon request. The general cell data contained therein is also applicable to the new Model 856, except for those characteristics affected by the method of casing.

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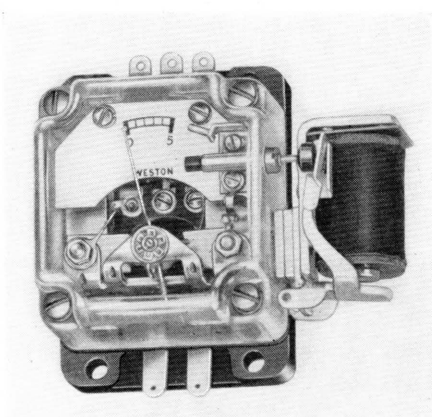
A DISCUSSION OF CONTACT MAKING RELAYS — PART II

MAGNETIC contact relays — SENSITROLS*—have a very practical characteristic in that their construction permits the use of a pointer and calibrated scale. In many applications, such as the explosive-gas alarm unit designed for chemical plant and mine use, an indication that the point at which the relay is set to operate is being approached may be valuable to the user. Yet, due to electrical or space limitations, it may be impossible or undesirable to employ a separate indicating microammeter. Where separate indication is necessary, as in connection with some electronic amplifiers, it necessarily adds to cost. The indicating scale of the magnetic contact relay may be calibrated in units appropriate to the application, such as gas concentration, temperature, footcandles, etc.

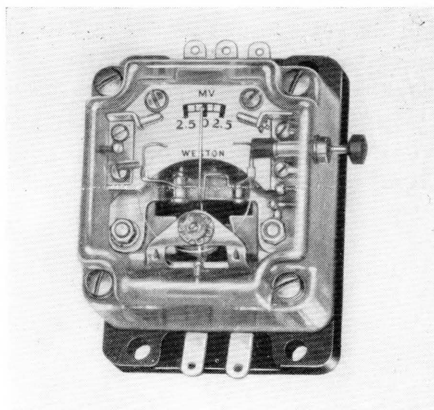


Model 813 Single Magnetic Contact Relay with Solenoid Reset.

The usefulness of calibrated contact adjustment is also quite convenient. Applications in which simple and rapid adjustment of the level at which the relay operates are frequently encountered. These requirements are met by a type of magnetic contact relay in which the fixed contact is adjustable to a range of operating values on the calibrated-indicating scale by means of a knob or adjusting screw on the front of the dial.

Another factor which often has a primary influence on the selection of relays and, in particular, on the satisfactory use of the magnetic contact type, concerns the periodicity of relay operation; in other words, the rate at which successive contact-making impulses are likely to occur. For example, in applications where a single positive closure of the relay is required, remaining in effect until some manual action is taken regardless of subsequent changes in the actuating condition, use of the magnetic contact relay permits a particularly simple arrangement. Such is the case for many alarm units where some individual is charged with the responsibility for correcting the condition and resetting the alarm.

In other situations, an automatic reset may be desirable, but with a delay for a certain length of time between successive responses of the relay. In certain control applications, operation of the relay may set in motion a series of electrical or mechanical steps, and it may be desirable that the relay be returned to its "On Guard" position only after time has elapsed for certain readjustments to take place. This can be arranged simply and easily with the magnetic contact relay by con-



Model 813 Double Magnetic Contact Relay with manual push button.

trolling the resetting of the relay with a clock mechanism or time-delay switch. Similarly, where the completion of some mechanical change should precede returning the relay to action, it is usually not difficult to correlate resetting with completion of the change, either mechanically or electrically.

Where the relay operation must be repetitive in rapid succession, as in a high-speed counting operation, magnetic contact relays have a relatively limited application. By the use of the solenoid reset feature, however, it is possible to meet requirements for repetitive response up to about 10 contact-making cycles per second.

The fact that the magnetic contact relay "makes" contact at a calibrated value but does not "break" contact with a subsequent decrease in the actuating energy below this level is a less serious limitation than it may appear initially. For example, where the sensitivity requirements are more extreme than a sensitive make-and-break relay can reliably cope with, the use of two magnetic contact relays, one "making" on the energy increase and one set to close on the subsequent decrease, can be incorporated in the circuit, if need be, to perform the same functions. This is the system used in a commercial type of illumination control relay. A double-fixed contact relay with automatic solenoid reset is also available for related applications where it is desired to make contact on increasing and decreasing values at either side of a normal open-circuit-zone.

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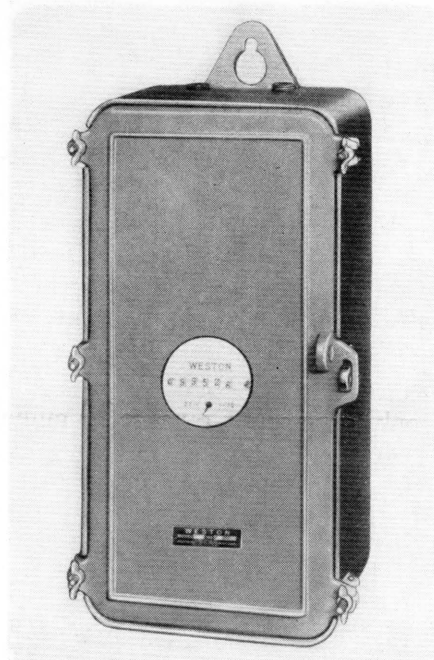
THE WESTON MODEL 808 INDUSTRIAL INTEGRATOR

SINCE the introduction of the Weston Model 807 Light Integrator, a demand has developed for integration of electrical magnitudes in general industrial service; for example, heavy currents as measured by low-drop shunts. Specifically for this class of service, the Model 808 Industrial Integrator has been designed and is offered where continuous, sensitive, and accurate integration is required under industrial conditions of service. It offers broadly a means for simple and effective time integration of d-c magnitudes having an order of level sufficient to operate conventional sensitive indicating instruments, and with a comparable order of operating accuracy.

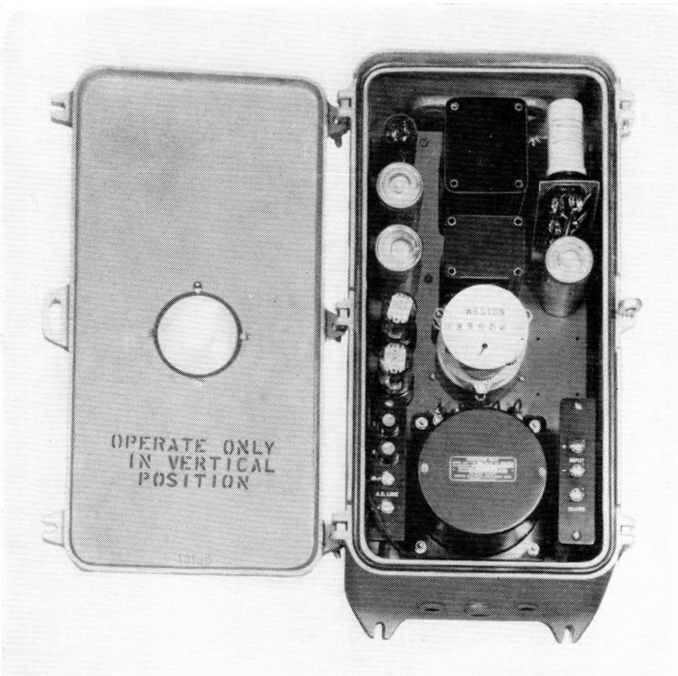
The general theory of the Weston method of integration has been described in WESTON ENGINEERING NOTES, Volume 1, No. 3, "A Sensitive Direct Current Electrical Integrator." Additional information is contained in the article "The Weston Model 807 Light Integrator" in the same issue.

Performance

The integrating system is basically a potential-input method, with current input accommodated where desired by an appropriate shunt. The integrating mechanism, a Model 806 Integrating Relay, may be made in a variety of coil resistances from about 10 to about 1,500 ohms, which can accommodate input levels from about 2 to 500 millivolts effectively. In a specific relay, however, the input level range is recommended to not exceed a ratio of 25 for an operating accuracy of 1%. Thus, for example, a single relay might be operable over a level range of 2 to 50 millivolts, another over a range of 10 to 250 millivolts, etc. Several types covering the entire feasible range of input levels are listed in Table 1, together with the integral unit adjustment for each type.



The Model 808 is housed in a cast aluminum dust-tight case.



Internal view of the Model 808 Industrial Integrator. A full access door is provided to permit complete removal of equipment and chassis.

In contrast to indicating instruments, the integrating process maintains a potential balance in the input circuit and lead resistance is not critical; the only current which flows is that required to overcome friction losses. The external potential circuit resistance may vary up to the order of resistance of the relay coil without causing an appreciable error.

For current integration, a shunt is applied to develop a corresponding potential for operation of the integrating relay. In this case, the maximum operating level of current is a function of the shunt and no inherent limit applies. But a low limit is determined by the highest resistance relay connected to a shunt of a resistance not exceeding that of the relay coil. This develops a low operating level limit of about 15 microamperes in an optimum design.

For potential input levels exceeding 500 millivolts it is necessary to include a voltage divider, usually having a resistance of 1,000 ohms per volt. This sacrifices potential balance in the input circuit which is normally of no consequence with input circuits having this order of resistance.

General Design

In contrast to the Model 807, which is a control instrument, the Model 808 industrial device is a continuous non-resetable totalizer only. The count range is 10 million before repeating, which for a typical count periodicity of 5 seconds corresponds to a time of approximately 15,000 hours or a little less than 2 years. The counter consists of a 100-unit rotary pointer and scale and a 5-dial drum-type totalizer operated in units of pointer revolution. The revolution of the counter permits hourly logging, at normal operating rates, within the basic accuracy of the instrument. The counting unit corresponds to the specific unit adjustment of the integrating relay and input circuit; ampere-hours, volt-seconds, etc.

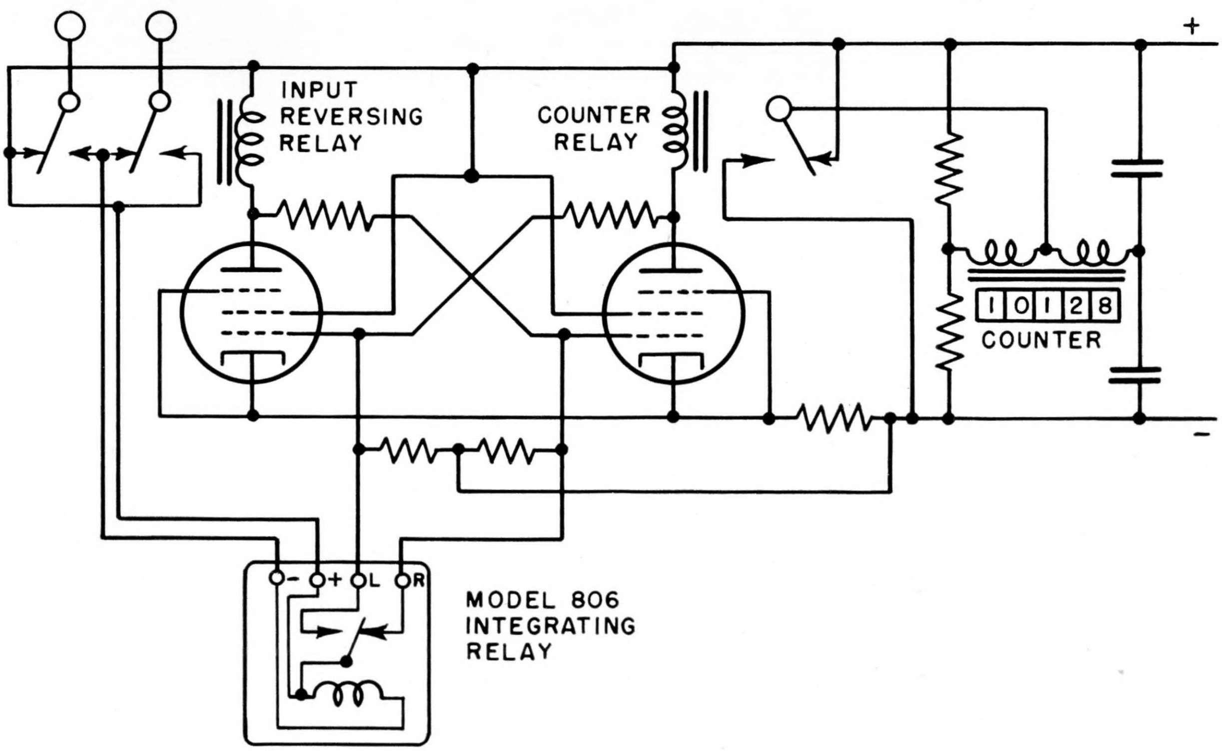
The equipment is chassis mounted and cased in a cast aluminum dust-tight housing arranged for permanent conduit mounting. A full access door permits complete removal of the chassis for servicing without dismounting the case.

It is regularly supplied for 110 volts, 60 cps, a-c power supply and has a 25-watt power demand. The supply voltage may fluctuate between 95 and 135 volts without damage or loss of accuracy.

Guarding and Shielding

The operating circuit is insulated from the power line and from ground, but in some cases surge or leakage conditions may require additional recognition. The system is therefore guarded and shielded for applications where the input circuit is sensitive to leakage or subject to surges.

The operating circuit is insulated from the chassis and the chassis in turn is heavily insulated with ¼-inch gap clearance from the case, which is normally grounded. The operating circuit is isolated from the power line by the power transformer which is rated at a 1,200 volt a-c, one-minute breakdown test. The chassis circuit is brought to a private terminal which can be connected by a separate wire to a point on the input system having the same surge potential as the input leads. Surge currents will then circulate in this third shield connection and the surge potentials appear between the chassis and the grounded case rather than between the wiring and the chassis. Or alternatively, the chassis shield lead may be connected to serve as a leakage shield if the input circuit is at an appreciable d-c potential above ground. Where required, the case door can be equipped with



Simplified circuit diagram of the Model 808 Industrial Integrator.

safety interlock switches to open the input and shield circuits for safe access.

Vacuum Tube Complement

Three vacuum tubes are used, as follows:

2—Type 6K6 Power Pentodes (relay tubes)

1—Type 5Y3 Rectifier (power supply)

These types are commonly available locally as radio tubes and no difficulty obtaining replacements need be anticipated.

Circuit

The circuit in somewhat simplified form is shown on page 5. The function of the vacuum-tube system and its co-operation with the primary integrating relay is similar to that of the Model 807 Light Timer, to provide reliable contact operation. The control and reset functions of the Model 807 have been eliminated, and the power supply section is transformer operated for isolation from the power line.

In anticipation of continuous service, the telephone relays used in the Model 807 are here replaced by mercury-wetted, sealed-reed-type relays in plug-in mounts. The reed relays are considerably faster than the original telephone types, promoting better operating accuracy, and are rated at a life of 1 billion operations which far exceeds any minimum life requirement.

Life Expectancy

The vacuum tubes are the only components having a limited service life, and routine replacement at 2,000 service hours is recommended. Otherwise, the equipment may be expected to operate to a count exceeding 10 million units, corresponding normally to years of service. A life test to date has totaled 18 million continuous operations without failures other than vacuum-tube faults.

In the general design and selection of components, the major consideration was continuous service life as an industrial process instrument. To this end, preliminary experimental models were field tested to point up required improvements, which has resulted in a tested design capable of a reasonable service life.

Adjustments and Operating Level Ranges

The adjustments listed in Table 1 are suggested as covering the range of permissible operating levels of potential input. The adjustment figure is the potential-time integral for a unit count (millivolt-seconds). The approximate relay resistance represents also the maximum tolerable resistance in the external circuit before appreciable loss of accuracy. The maximum, minimum and design center operating levels indicate the range of operating level and the center level which should be of the same order as the actual average input level. Usually that adjustment having a design center level closest to the actual average level of operation is recommended. An adjustment of 200 millivolt-seconds is recommended for use with 50 millivolt shunts, as noted.

Current adjustments may be supplied self-contained up to 1 ampere maximum level with an adjustment of 2 ampere-seconds per unit count, and down to a minimum level of 15 microamperes with an adjustment level of 750 microampere-seconds per unit. For currents higher than 1 ampere an external shunt of any standard 50 millivolt type is used with the 200 millivolt-second potential adjustment. When designing or using shunts it must be recognized that contrary to millivoltmeters the integrator draws no appreciable current, and a shunt adjusted for an instrument load must be burdened properly by the instrument for which it was designed or by an equivalent resistance.

E. N.—No. 55 —*R. W. Gilbert*

Table 2
Weston Model 808 Industrial Integrator, General Specifications

Size and Weight: Approximately 19″ high x 9″ wide x 6.5″ deep, 26.5 lbs.

Mounting: Vertical wall mounting only, ½″ conduit connection.

Power: 110 volts, 60 cps, 25 watts demand, external line switch (not supplied), internally fused for 1 ampere (3-AG) both sides.

Case: Cast aluminum, full access door with padlock hasp, gasketed and dust tight.

Totalizing Range: 10 million units before repetition, non-reset; 100-unit circular dial and 5-digit drum counter.

Input Level Ranges: 10 to 500 millivolts in available adjustments; single adjustments to cover input ratio not greater than 25; current shunts self-contained to 1 ampere maximum.

Operating Rate: Recommended level range limits correspond to counting rates of 0.5 unit/sec. to 0.02 unit/sec., or 2 to 50 seconds per unit count respectively.

Input Circuit: Total external resistance not to exceed the resistance of the relay coil (10 to 1,200 ohms depending upon adjustment); calibrated leads not required.

Shielding: Surge and leakage guarding and shielding included; surge maximum 1,000 volts self-contained, and 5,000 volts with suitable external isolation transformer.

Table 1
Suggested Adjustments and Level Ranges

Adjustment (millivolt-seconds)	Operating Levels (millivolts)			Approximate Integrating Relay Resistance (ohms)
	min.	design center	max.	
100	2	10	50	13
200*	4	20	100	50
500	10	50	250	200
1,000	20	100	500	1,200

* Recommended for use with 50 millivolt shunts.

POTENTIAL AND CURRENT TRANSFORMERS FOR STANDARDIZING A-C VOLTMETERS AND AMMETERS

THE MODEL 311 Standardizing Potential Transformer is specifically designed for use in standardizing a-c voltmeters. Ranges of 1.5 to 300 volts in convenient steps are provided and when used in connection with a Weston Model 461 Type 5 Current Transformer, currents of 0 to 50 amperes can be obtained and measured accurately for adjustment and calibration of a-c ammeters.

Voltage Measurements

The conventional instrument potential transformer is usually provided with one or more primary windings for connection to a voltage supply and with a secondary winding for connection to a voltmeter standard. This system can be used for standardizing a-c voltmeters by connecting the instrument under test to the primary, but it is limited in the ranges available and requires an additional transformer to provide the regulated primary voltages which in general differ widely from the usual 120-volt source.

The Model 311 Standardizing Potential Transformer overcomes these objections by using three windings, one primary and two secondaries. The primary winding

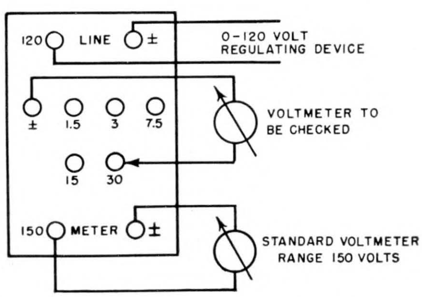


Figure 1—Connection diagram of Model 311 Potential Transformer for ranges of 1.5 to 30 volts.

has a rating of 120 volts, 50-125 cycles, for connection to a variable auto-transformer or any other suitable regulating device. The secondary standard winding has a range of 150 volts and is connected to an accurate voltage standard. The standard voltmeter should have ranges of 300/150/75 volts and a full scale loss of less than 100 ma.

The other secondary consists of a tapped winding for ranges of 30/15/7.5/3/1.5 volts. The instrument to be tested is connected to the appropriate range of this winding. In addition, the transformer windings can be connected to provide voltages as high as 300 volts from the same supply voltage.

When the voltage at the standard secondary winding is 150 volts, the tapped secondary voltages are as indicated above. Reducing the primary voltage reduces all secondary voltages the same proportionate amount, therefore, both the full scale adjustment and calibration can be checked by merely connecting the standard winding to the 150-volt range of the voltmeter standard and the instrument under test to one of the tapped secondary windings. See Figure 1. By this means, ranges 1 to 30 volts can be standardized.

Instruments with ranges above 30 volts to 75 volts can be checked by connecting them directly to the regulating device along with the 75-volt range of the standard voltmeter. Instruments having ranges above 75 volts to 150 volts are checked by connecting them to the 150-volt standard winding. Voltages up to 300 volts are obtained by connecting all windings in series to form an auto-transformer as shown in Figure 2.

The standardizing transformer provides accurate voltages with a minimum of ratio error because the secondary voltages only are compared. Voltage drops in the primary, due to the magnetizing current and reflected secondary currents, do not therefore affect the accuracy. The ratio between the two secondary windings, however, is affected by the secondary voltage drop which is equal to the secondary resistance times the secondary current. This ratio error will be less than 0.1% of the marked secondary rating provided the standard voltmeter requires less than 100 ma and the voltmeter under test less than 500 ma. If these ratings are exceeded, a larger ratio error may result.

The ranges of the Model 311 Transformer can be extended downward by using another standard voltmeter having a 15-volt range.

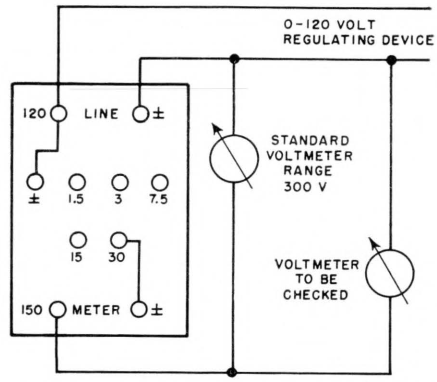


Figure 2—Connection diagram of Model 311 Potential Transformer for 300-volt range.

The tapped secondary ranges will then become 3/1.5/0.75/0.3/0.15 volts. This method, while often useful, does not provide the same accuracy as mentioned previously since the standard voltmeter usually requires quite a high current. An accuracy of 0.5% or better can be expected with this method for most secondary load conditions.

While the Model 311 Transformer was designed primarily for 60-cycle service, it can be used at higher frequencies with slightly poorer accuracy. At 400 and 800 cycles the accuracy is 0.2 and 0.3% respectively, in place of 0.1% as indicated for 60-cycle service.

Current Measurements

The Weston Model 461 Type 5 Current Transformer has a secondary range of 5 amperes and primary ranges of 500/250/100/50/25/10/5/2/1/0.5 amperes. The three higher ranges are obtained by passing a conductor through the opening in the center of the case. Passing the conductor through once is required for the 500-ampere range, twice for the 250-ampere range and five times for the 100-ampere range. The lower ranges are obtained by connecting to the binding posts on the top of the case. This transformer has a frequency range of 50 to 125 cycles for a maximum secondary burden rating of 15 volt-amps.

Use of Potential Transformer as a High Current Source

A-c ammeters can be checked easily by using this transformer and a 5-ampere standard ammeter as the measuring device with a suitable source of the heavy current. Since the Model 311 Standardizing Transformer has heavy secondary windings, it can be used as a suitable source for the heavy current, and thus becomes a low voltage power unit in addition to its use as a potential transformer. As shown in Figure 3, the standard ammeter

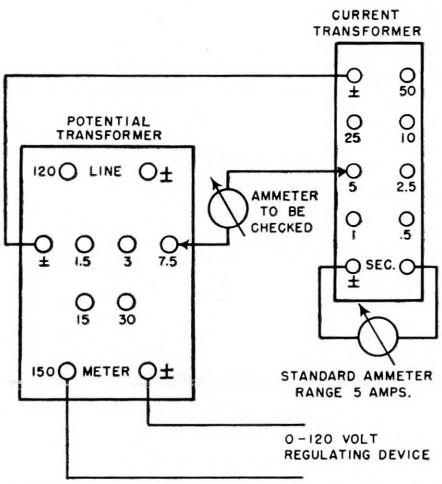


Figure 3—Connection diagram of Model 461 Current Transformer and Model 311 Potential Transformer for checking ammeters.

is connected to the secondary of the current transformer and the ammeter to be checked is connected in series with the proper primary range and to one of the low voltage secondary windings. The regulating device is shown connected to the 150-volt secondary winding since this winding uses a larger wire than the primary winding and can safely carry the necessary current.

The secondary voltage range used will depend upon the voltage drop of the meter under test, as well as the voltage drop of the transformer windings and standard ammeter. In order to estimate the voltage required, Table 1 was prepared showing the primary voltage drops of the current transformer for secondary burdens of 1, 5 and 10-volt amperes which correspond to the burdens of the 5-ampere Weston Models 433, 370 and 326, respectively. If the voltage drop of the ammeter to be tested is known, it can be added to the primary voltage drop to determine the proper voltage range. If the voltage drop of the instrument being tested is unknown, the low range should be tried first and higher ranges next until the proper voltage is obtained.

Secondary Burden	Ratio Error—% of Marked Rating		
	60 Cycles	400 Cycles	800 Cycles
1 VA (Mod. 433)	0.2	0.25	0.3
5 VA (Mod. 370)	0.1	0.1	0.15
10 VA (Mod. 326)	0.15	0.15	0.15

Table 3—Ratio Error of Model 461 Type 5 Current Transformer.

Range in Volts	Maximum Current Capacity—Amperes	
	Continuous Duty	Intermittent Duty
1.5	25	50
3.0	25	50
7.5	25	..
15.0	15	..
30.0	10	..

Table 2—Current-Carrying Capacity of Model 311 Potential Transformer Secondary Windings.

In order to avoid overheating the potential transformer, the maximum current carrying capacity of the Model 311 Transformer is shown in Table 2. These values should not be exceeded since permanent damage may result. It should be noted that the 1.5 and 3-volt ranges have an intermittent rating of 50 amperes. This was listed so as to cover ranges up to 50 amperes. When this winding is used above its continuous rating of 25 amperes, it should only be used long enough to take a reading and then allowed to cool for a few minutes.

Ranges above 50 amperes cannot be checked using the Model 311 Potential Transformer although the current transformer can be used for ranges as high as 500 amperes. For the higher ranges, a special transformer capable of supplying this current must be used.

The accuracy of the Model 461 Type 5 Current Transformer depends upon the frequency and secondary burdens. Table 3 lists the accuracy as a percentage of the marked rating for three burdens and three frequencies. While the transformer was designed primarily for 60-cycle service, it may be used with slightly poorer accuracy at 400 and 800 cycles as shown in Table 3.

Using a standard ammeter with a range lower than 5 amperes so as to provide primary ranges below 0.5 ampere is not recommended since large errors may occur. For example, a 0.5-ampere ammeter having a burden of approximately 0.5-volt ampere (at 0.5 ampere) and used as the standard will cause the ratio to be incorrect by approximately 2.5% at full scale and approximately 3.5% at one-half scale. This will provide additional primary ranges of 0.05, 0.1 and 0.2 ampere but the accuracy is so poor that a correction factor would have to be determined and applied throughout the scale to bring the accuracy within reasonable limits. Instruments having a higher burden will cause a much greater ratio error.

The Type 5 Current Transformer can also be used to make direct measurements of load currents. It should be noted, however, that the primary voltage drop of the low ranges will decrease the voltage across the load, making it necessary to increase the supply voltage.

Range in Amperes	Primary Voltage at Rated Current for Secondary Loads of:		
	1 VA (Mod. 433)	5 VA (Mod. 370)	10 VA (Mod. 326)
0.5	12.0	20.0	36.0
1.0	8.0	12.0	20.0
2.5	3.5	5.0	8.5
5.0	1.8	2.7	4.2
10.0	1.0	1.4	2.2
25.0	0.45	0.60	0.95
50.0	0.25	0.35	0.50

Table 1—Primary Voltage of Model 461 Type 5 Current Transformer at Rated Current, 60 Cycles.

E. N.—No. 56 —*R. Estoppey*

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