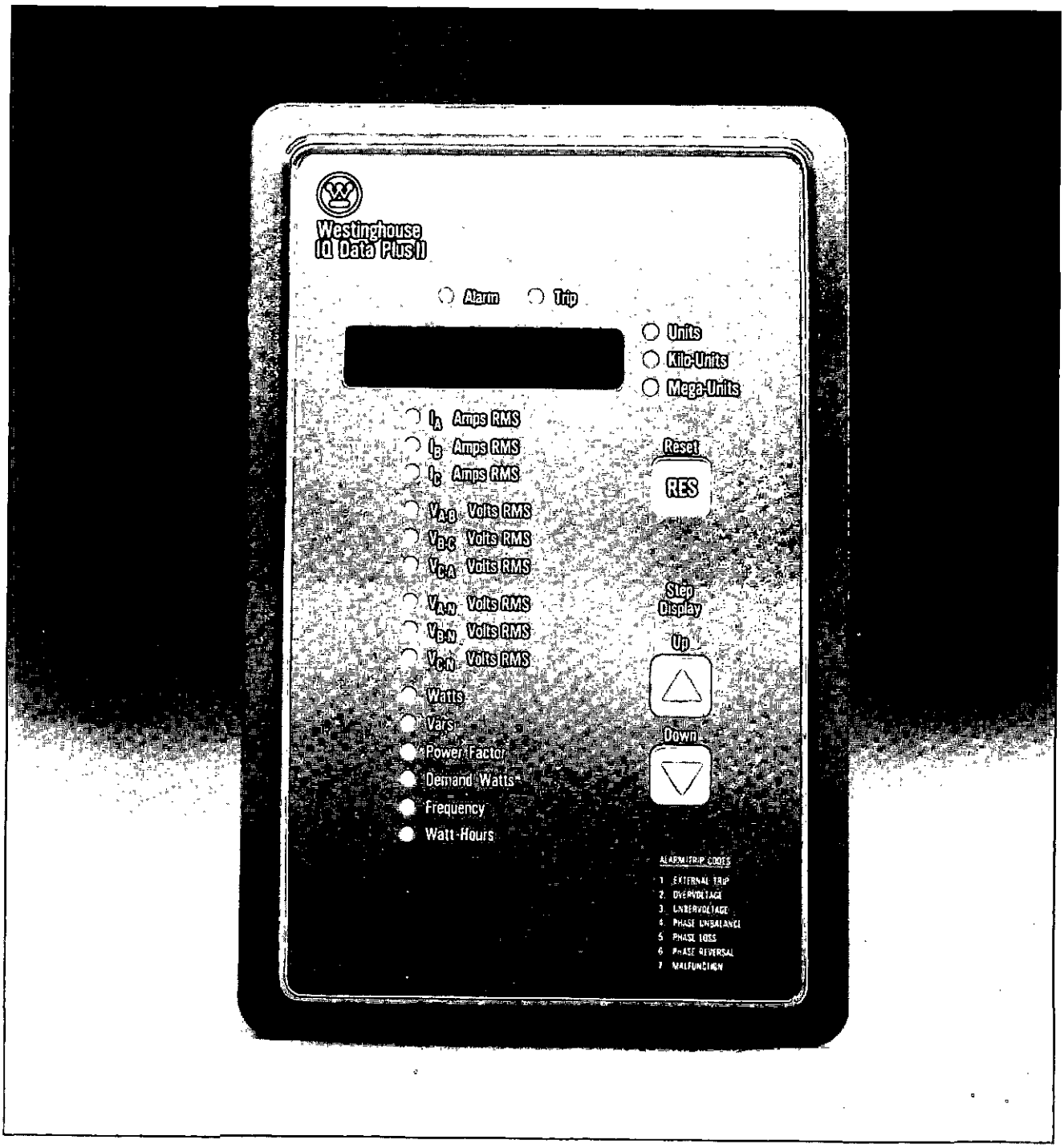
Westinghouse Electric Corporation
Distribution and Control Business Unit
Electrical Components Division
Pittsburgh, Pennsylvania, U.S.A. 15220

December 1989
New Information
Mailed to: E, D, C/8100A, 8200A

IQ Data Plus II



IQ Data Plus II™ The Ultimate In Monitoring
The IQ Data Plus II is a microprocessor based monitoring and protective device that provides complete electrical metering and system voltage protection. In one compact, standard package, the IQ Data Plus II provides an alternative to individually mounted and wired ammeters, voltmeters, ammeter and voltmeter switches, wattmeters, watthour meters, and more.

Direct Reading Metered Values

- AC Ampere — Phase A, Phase B, Phase C — 1% Accuracy
- AC Voltage — 1% Accuracy
  - Phase A-B — Phase A-Neutral
  - Phase B-C — Phase B-Neutral
  - Phase C-A — Phase C-Neutral
- Watts — 2% Accuracy
- Vars — 2% Accuracy
- Power Factor — 4% Accuracy
- Frequency — 0.5% Accuracy
- Watt Demand — 2% Accuracy
- Watt Hours — 2% Accuracy

General Specifications

Style Numbers
2D78522G01 With 3-Phase power supply
2D78522G02 With Single-phase power supply

List Price (both models) **$1975**

Device's Power Requirement
3 Phase PT Burden 10 VA
C.T. Burden 0.003 VA

Frequency 50/60 Hz

Line Characteristics
- Nominal Line ±20%
- Will continue to operate in event of a phase loss

Operating Temperature 0° to 70°C (32° to 158°F)

Storage Temperature −20° to 85°C (−4° to 185°F)

Humidity 0 to 95% R.H. noncondensing

Fuses (Supplied with the unit) (3 required) 1 ampere, 600 volts Buss type KTK-R-1

Trip/Alarm/WH Contact Ratings
10 amperes @ 120/240 VAC (Resistive)
10 amperes @ 30 VDC (Resistive)

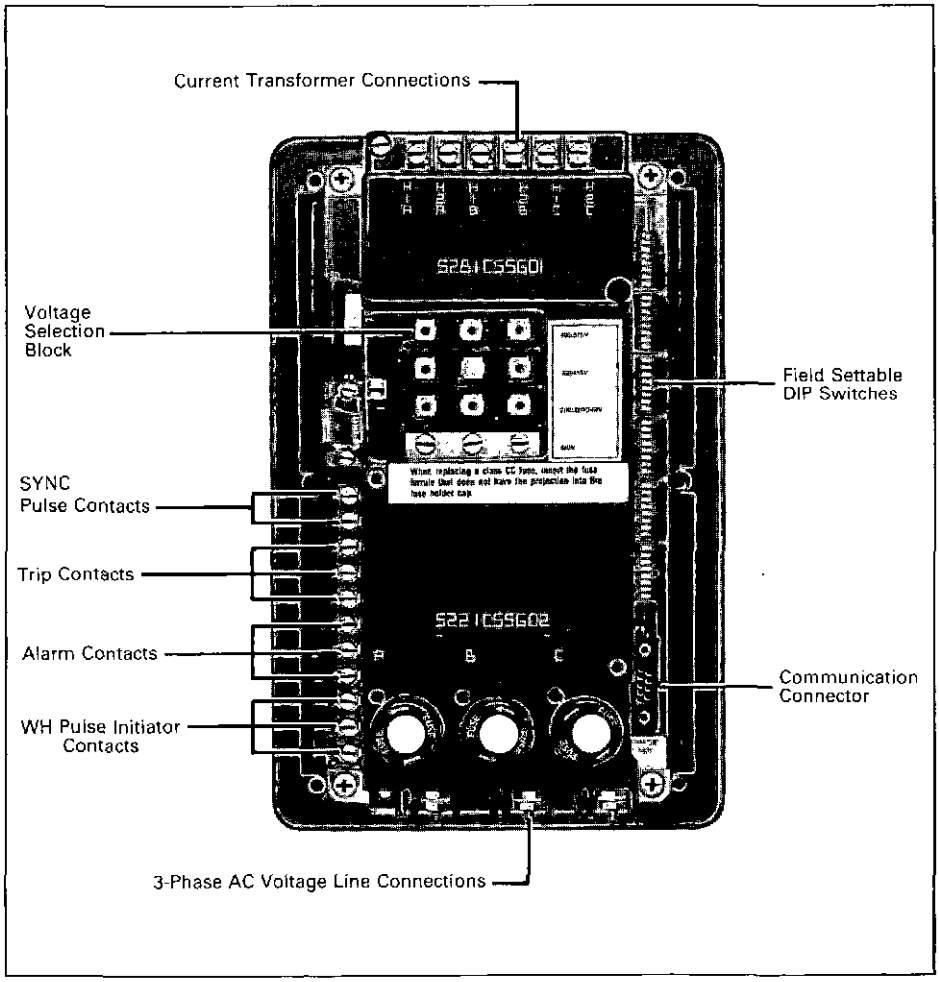
Weight 6.5 lbs

Input Ranges –
- Current Transformers – 100/5 through 5000/5
- Potential Transformers – Self contained up to 600 volts. Above 600 volts, potential transformer inputs to 14.4KV.
- CT & PT ratios field settable with DIP switches – refer to "Rear View"

Additional Features
- Pulse Initiation on watthour pulse as programmed by the user at certain KWH or MWH rates.
- A sync pulse contact for the demand window provides for synchronizing time with the utility. (Rated 24 VDC)
- Auto ranging of units. (units, kilounits, megaunits)
- Alternate power factor calculation. (for unbalanced and nonsinusoidal waveforms.)
- Simple electrical connections (Same as a Wattmeter)
- 50/60 Cycle
- 3 Wire or 4 Wire Systems
- Door mounted (4.5 inches depth)
- Self protected from fault
- Updated data every 1.5 seconds
- Optional communication port for two wire connection to Westinghouse INCOM network

Customer Benefits
- Space savings in structure – Replaces Ammeter, Voltmeter, Selector Switches, WattMeter, etc.
- Standardization of design – One door mounted device
- Direct voltage input up to 600 volt – No additional PT's required
- User friendly – Field settable DIP switches
- Order simplification – 2 style numbers, relating only to power supply. In-line power supply and separate source power supply. Do not need to stock different face plates for different CT and PT ratios.
- A 36-inch extension cable (style 7871A40G02) can be obtained for mounting voltage power module separately from unit
- Reductions in shop wiring – Only CT & PT (current transformers, potential transformers) hook up required to a single device. No separate potential source required.
- Protection relaying included – Can be programmed active or inactive.
- Energy Management – Watts, Power Factor, Watt Demand and Vars

Rear View



- Interface capability to computer network for data collection, storage and/or printout via INCOM – The Westinghouse two-wire local area network
- Membrane faceplate designed and tested to perform in a harsh industrial environment (NEMA 3R, 12)
- Retains preset parameters through power failure with use of field settable DIP switches (no batteries).
- Nonvolatile memory for storage of readings at time of trip.
- Separate Alarm and Trip relay outputs
- UL recognized
- CSA certified
- ANSI C37.90

Field Settable Protection Functions With Trip And/Or Alarm Outputs

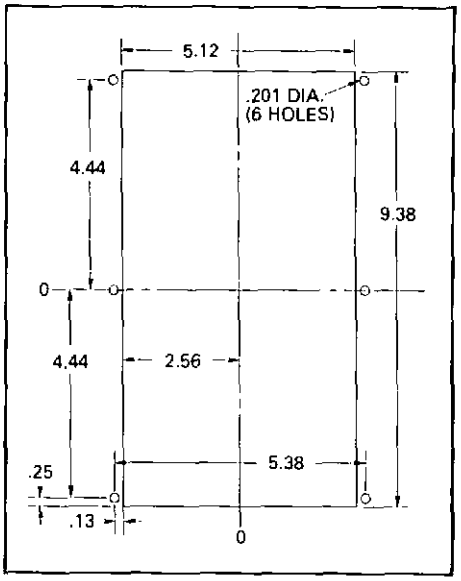
- Phase Loss (Voltage or Current)
- Phase Unbalance (Voltage)①
- Phase Reversal (Voltage)
- Overvoltage①
- Undervoltage①

① Percent trip level and trip time interval is field settable.
② Updates itself 2/sec. all other protection functions 1/sec.

Description Of Protection Functions

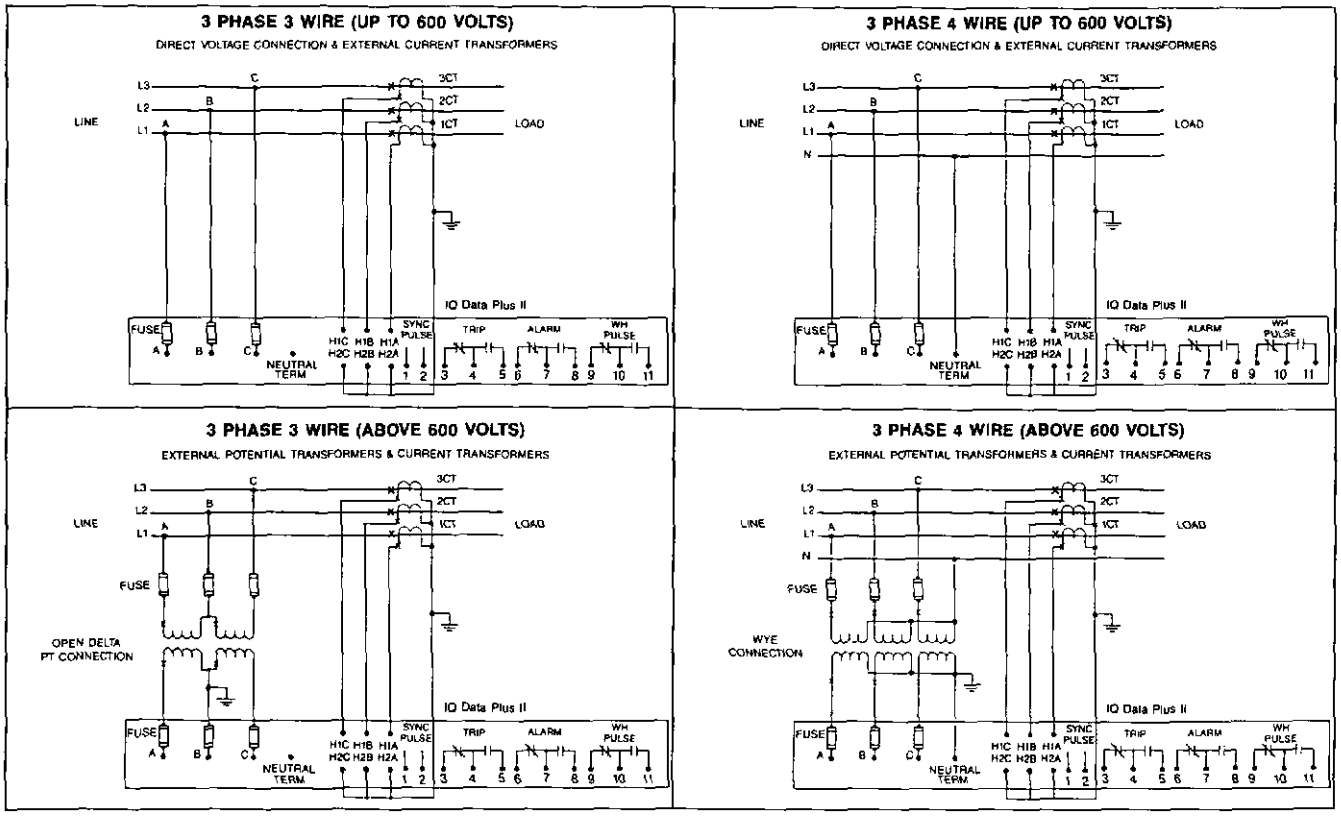
Phase Loss	Voltage – Phase loss occurs if less than 50% of nominal line voltage is detected. ②Current – Phase loss occurs if smallest phase current is less than 1/16 of the largest phase current.
Phase Unbalance	Occurs if the maximum deviation between any two phases exceeds the amount of unbalance as a percent of nominal line voltage preset by DIP switches. Range: 5 to 40% (5% increments)
Phase Reversal	Occurs if any two phases become reversed for more than one second.
Over Voltage	DIP switch setting of percent of nominal line volts. Range: 105 to 140% (5% increments)
Under Voltage	DIP switch setting of percent of nominal line volts. Range: 95% to 60% (5% increments)
Delay	Allows existence of overvoltage, undervoltage, or voltage unbalance before an alarm or trip occurs. Range: 0-8 sec. (1 sec. increment).

Drilling Pattern

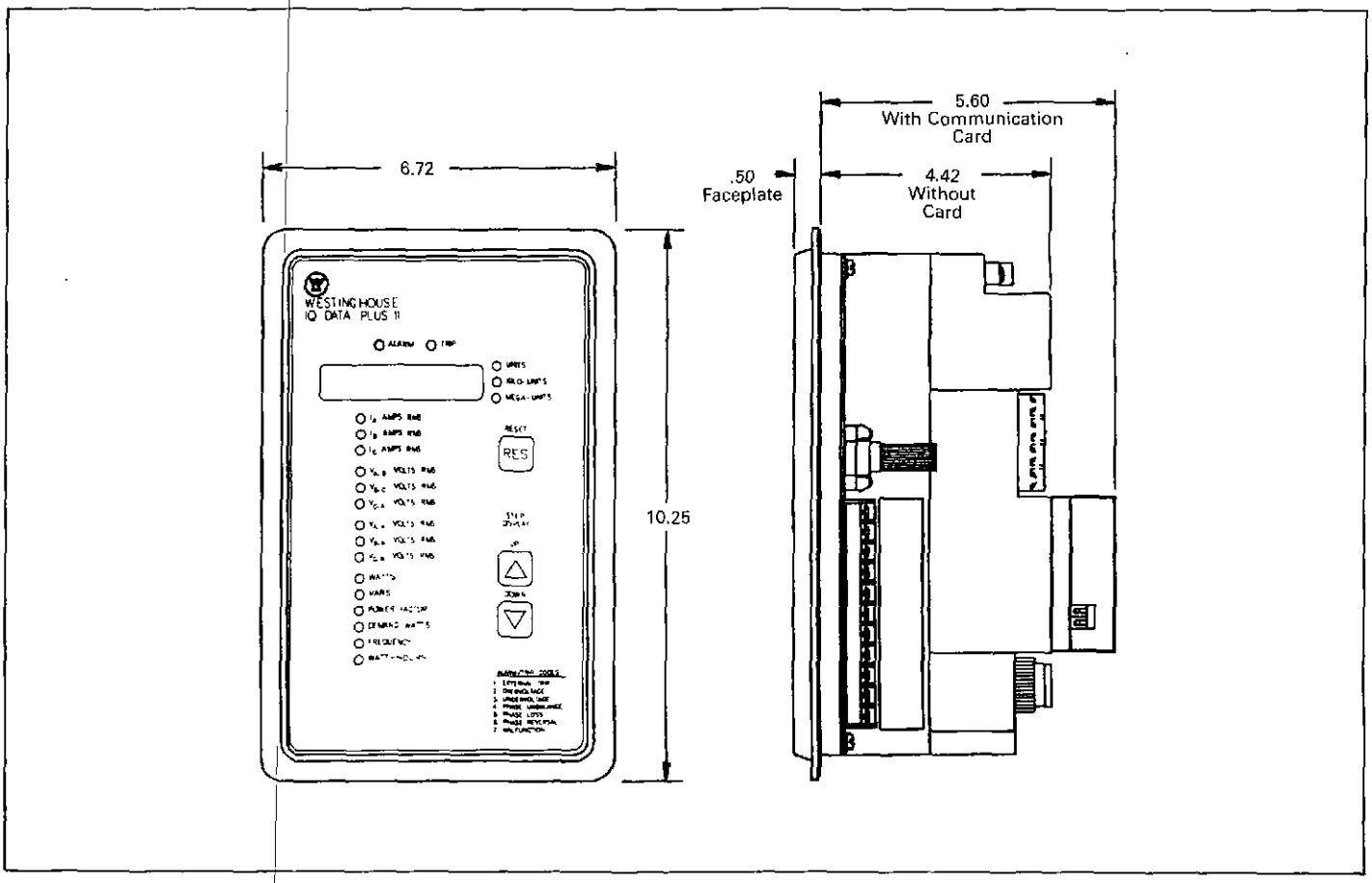


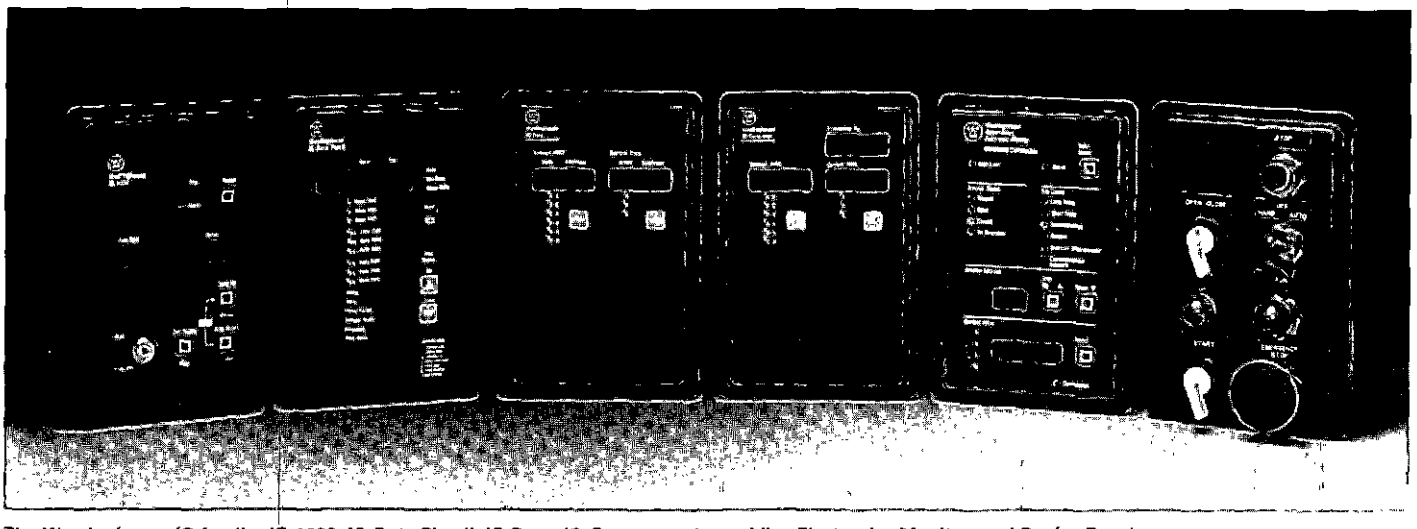
For additional pricing, see Price List 8174
For additional metering, see:
IQ Data (Descriptive Bulletin 8171)
IQ Generator (Descriptive Bulletin 8172)

Field Wiring Connections



Dimensions (In inches)





The Westinghouse IQ family: IQ-1000, IQ Data Plus II, IQ Data, IQ Generator, Assemblies Electronics Monitor, and Device Panel.

Westinghouse Electric Corporation
Distribution and Control Business Unit
Electrical Components Division
Pittsburgh, Pennsylvania, U.S.A. 15220

Printed in U.S.A.

December 1989

Instructions for Transfer Switches Automatic (Solid State Logic), Manual, and Non-Automatic 100-1000 Amps

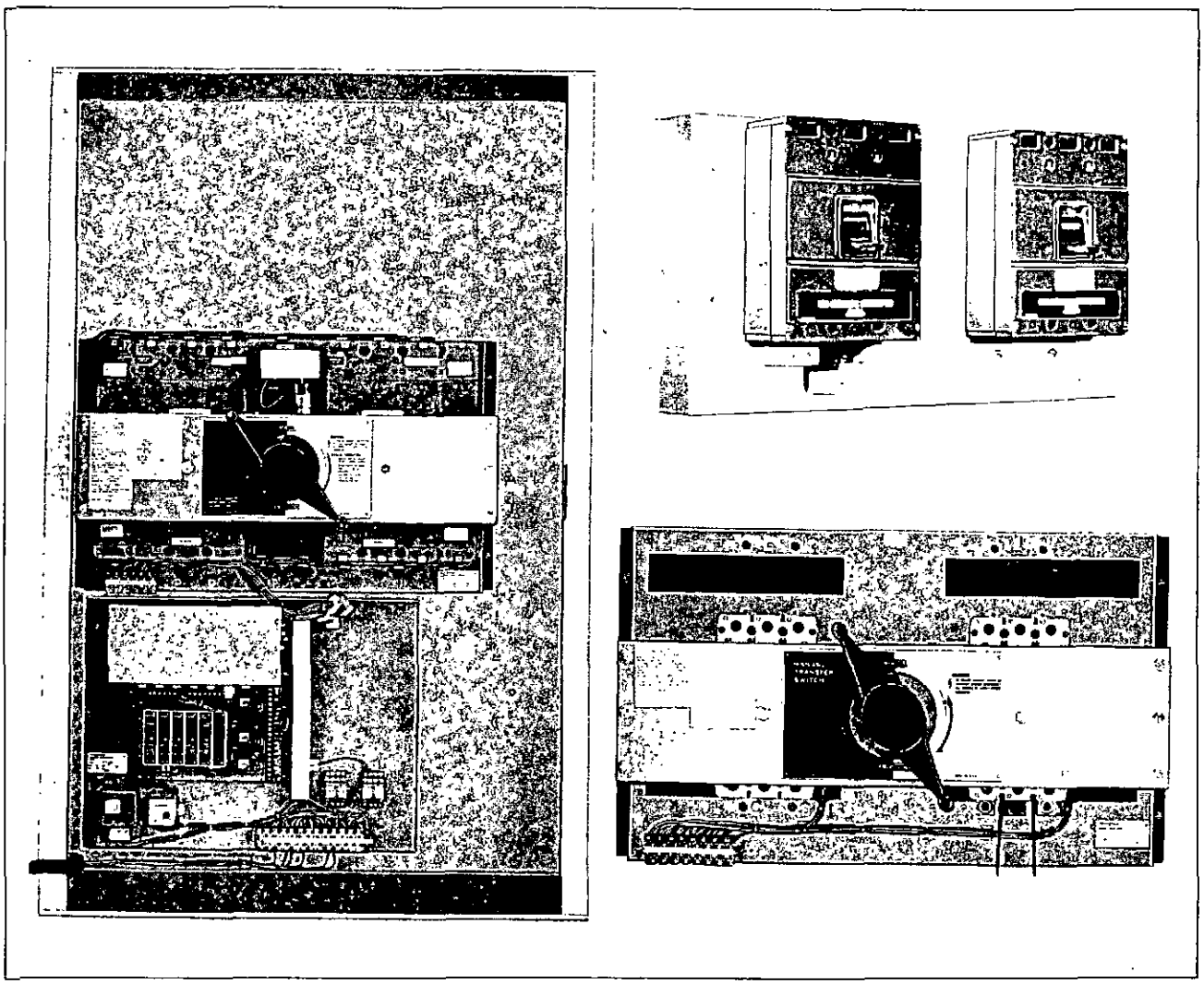
I.L. 14477-E
File 29-900

DANGER

VOLTAGE MAY BE PRESENT IN THIS EQUIPMENT WHICH CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.

USE EXTREME CAUTION WHEN INSTALLING OR ADJUSTING THIS EQUIPMENT.

Index	Page



Effective July, 1990 Supersedes I.L. 14477-D dated March, 1983

THE TRANSFER SWITCH

Transfer switches are used to protect critical electrical loads against loss of power. The transfer switch is connected to both normal and emergency circuits. In the event that power is lost from the normal source, the transfer switch transfers the load to the emergency or secondary source. Transfer is automatic if switch is automatic type; or must be done manually if manual or non-automatic type switches. The load is automatically/manually transferred back to the normal source when that power is restored.

In automatic transfer switches, when the normal power supply fails or falls below a preset voltage, the switches intelligence system initiates transfer. If the emergency source is commercial power, and it's present, the switch will immediately transfer to emergency. If the emergency source is a standby generator, the transfer switch initiates generator starting and transfers to the emergency source when sufficient generator voltage appears until normal power is restored, at which time it will retransfer to normal and initiate engine shutdown. The switch is suitable for use with commercial power or engine generator emergency sources without modifications. In the event the normal source fails and for some reason the emergency source doesn't appear, the switch will remain connected to the normal source until the emergency source appears, at which time transfer will be initiated; conversely, if connected to the emergency source with the normal source out and for some reason the emergency source should fail, the switch will remain connected to the emergency source.

Transfer switches covered by this manual range in rating from 100 to 1000 amperes. Ampere rating is determined by the rating of the circuit interrupters or optional automatic circuit breakers employed. The switch is designed to carry its full rated load current whether inductive or resistive. They are available either with their own enclosures or open for mounting in control panels, and they are supplied for either front-connecting cables or rear-connecting bus work.

The rating label is prominently affixed to the transfer switch. Data relating to each specific switch is included on the nameplate. Long and trouble free equipment life is assured by using the switch within the limits shown on the rating label and nameplate.

TYPES OF PROTECTION

Automatic transfer switches provide full-line voltage protection to a power circuit. Optional overcurrent/short circuit protection can be provided (Options 16/17/37) adding overcurrent protection to the connected power circuit.

Full-Line Voltage Protection (Standard on Automatic Units)

Field adjustable solid-state voltage-sensing logic is provided which monitors each phase of the normal power supply. The close differential adjustment is factory set to drop out when the monitored voltage drops below 70% of normal, and to pick up again at 90% of line voltage. Thus, if any phase of the normal power drops below the dropout setting, the logic will cause the transfer switch to seek the secondary power supply. When the line voltage is restored to the pickup setting in all phases, the switch transfers back to the normal power supply.

Overcurrent Protection (Options 16/17/37)

Transfer panels using breaker type construction can be provided to offer overcurrent protection by the addition of thermal-magnetic trip units to either one or both of the circuit interrupters. This feature of the transfer panel makes additional disconnect/overcurrent apparatus unnecessary. Short circuit protection is standard.

NOTE: When overcurrent protection, Options 16, 17, or 37 is selected and the circuit breaker containing this feature trips, the switch will not initiate transfer, nor will the engine start. The reason for this is that if the breaker trips, the fault is on the load side of the transfer switch, and it is undesirable to transfer a source into a faulted or overloaded condition. Reset of the tripped device can either be accomplished by the manual operator or electrically when Options 11C or 11D is supplied.

INSTALLATION

Transfer Switches are factory wired and tested. Installation simply requires mounting and connection of power cables and auxiliary pilot circuits. Do not remove protective packing until ready for complete installation. Protect switch at all times from excessive moisture, construction grit, metal chips, plaster, etc.

After uncrating the transfer panel, first make a visual check to see that there are no broken or damaged components and that there is no evidence of bent or distorted metal or loose wires as a result of rough handling.

Remove hardware, if furnished, securing switch to packing box or crate. Any lifting device must be attached to the switch mounting holes or mounting channels only. Do not lift switch at any other points. Protect the switch from impact at all times.

Remove any tied-down accessories, cardboard tubes, shipping wedges, and on larger units, remove tie-down

strings on the manual handle to assure that it turns freely in a counterclockwise direction. Options furnished for separate mounting; i.e., pushbuttons, etc., should be wired to the panel as indicated on the schematic. Jumper wires as indicated on the schematic should also be removed.

The transfer panel must be mounted on a flat, rigid supporting surface and in an atmosphere free of excessive moisture and excessively high temperatures, except those units approved for special environments. The panels provide ample room to permit cable entry from top, bottom or sides; however, care should be taken to prevent cables from retarding the action of relays and from covering the logic in a way that restricts adjustments. Maintain proper electrical clearance between live metal parts and grounded metal.

DANGER

POWER CONDUCTORS MAY HAVE VOLTAGE PRESENT WHICH CAN RESULT IN PERSONAL INJURY OR DEATH.

DE-ENERGIZE ALL POWER OR CONTROL CIRCUIT CONDUCTORS TO BE CONNECTED TO THE TRANSFER SWITCH BEFORE TERMINATING TO THE UNIT.

Power Cable Connections

Test all power cables prior to connection to the unit to ensure that conductors or cable insulation has not been damaged while being pulled into position. Power cables are to be connected to solderless screw type lugs located on the transfer switch circuit interrupters. Refer to wiring diagrams supplied with unit for power termination identification verify that the lugs supplied will accommodate the power cables being used. Standardly equipped transfer switches will accommodate the wire sizes as noted in Table 1.

Table 1

Transfer Switch Amp Rating	Wire Size Range	Number of Cables per Phase
100	#4 – 1/0	1
150-300	#3 – 350 MCM	1
400	250-500 MCM	2
600 (3P)	#1 – 500 MCM	2
600 (4P)	3/0 – 400 MCM	3
800	3/0 – 400 MCM	3
1000	4/0 – 500 MCM	4

Carefully strip insulation from the power cables avoiding nicking or ringing of the conductor strands. Prepare stripped conductor termination end by cleaning with a wire brush. If aluminum conductors are used, apply an appropriate joint compound to the clean conductor surface area. Tighten cable lugs to the torque identified on the label affixed to the unit immediately adjacent to the lugs.

WARNING

IMPROPER POWER CABLE CONNECTIONS CAN CAUSE EXCESSIVE HEAT GENERATION AND SUBSEQUENT EQUIPMENT FAILURE.

The engine's starting controls must be wired to the panel's engine start contact as indicated on the schematic wiring diagram.

Reread and understand all instructions on the diagrams and labels attached to the switch.

After the panel is installed, a check should be made to assure that the manual handle operates both breakers properly. Handle operating procedure is printed on the nameplate.

First check Transfer Switch nameplate for rated voltage. It should be the same as the normal and emergency line voltages. Operating the switch on improper voltage can cause damage.

If Option 4 is furnished, an engine start signal will be present for a period of time equal to the timer setting when the switch is first energized. To avoid starting the engine during this time, turn the generator controls to the OFF position.

CAUTION

The Transfer Switch will now be energized. Proceed with care!

Close the normal source circuit breaker. The switch should be in normal position.

Use an accurate voltmeter to check phase-to-phase and phase-to-neutral voltages present at the Transfer Switch normal terminals.

Close the emergency source circuit breaker.

Manually start the engine-driven generator at the set. (If used.)

Use an accurate voltmeter to check phase-to-phase and phase-to-neutral voltages present at the Transfer Switch emergency terminals.

If necessary, adjust the voltage regulator on the generator according to the manufacturer's recommendations. The Automatic Transfer Switch will respond only to rated voltage and frequency specified on the nameplate.

If the switch is operated manually with the Normal source connected, the switch will cycle back to Normal since it is the preferred source. Handles on 150 amp and larger switches free-wheel, so that the mechanism operates and the handle ratchets so that the handle can be held while the switch operates without causing injury.

Checks should be performed by a competent electrician familiar with the schematic circuitry of the transfer panel.

All components mounted on the transfer panel are identified with their specific function; and all of the wiring, with the wire number as shown on the schematic wiring diagram.

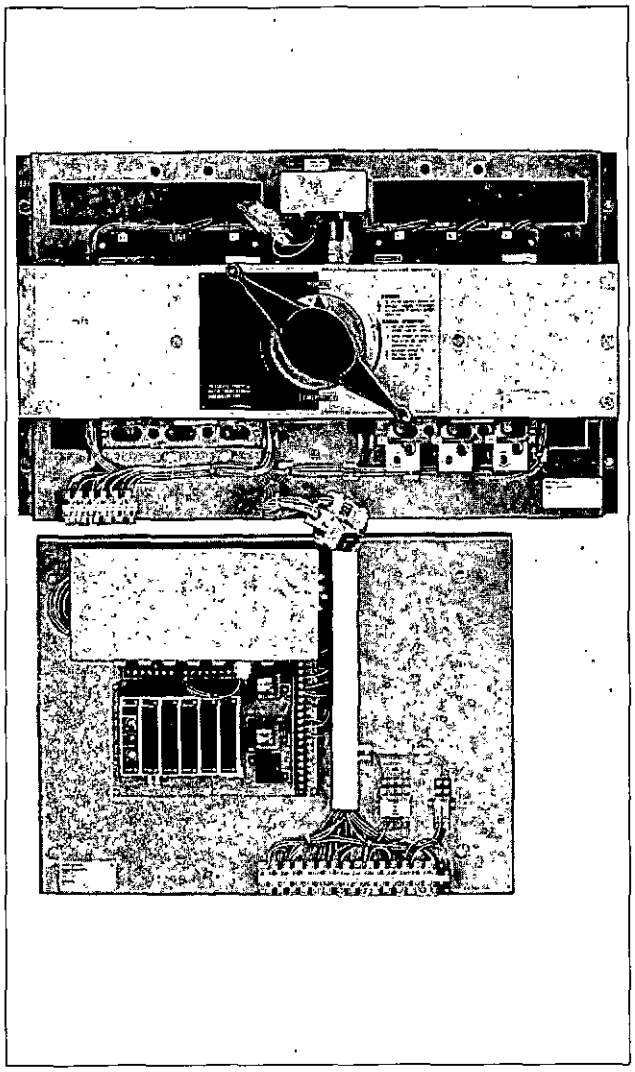
Shut down the engine-driven generator, then put starting control in "Automatic" position.

Place the Auto/Test Switch in the test position. The engine should start and run usually within 15 seconds.

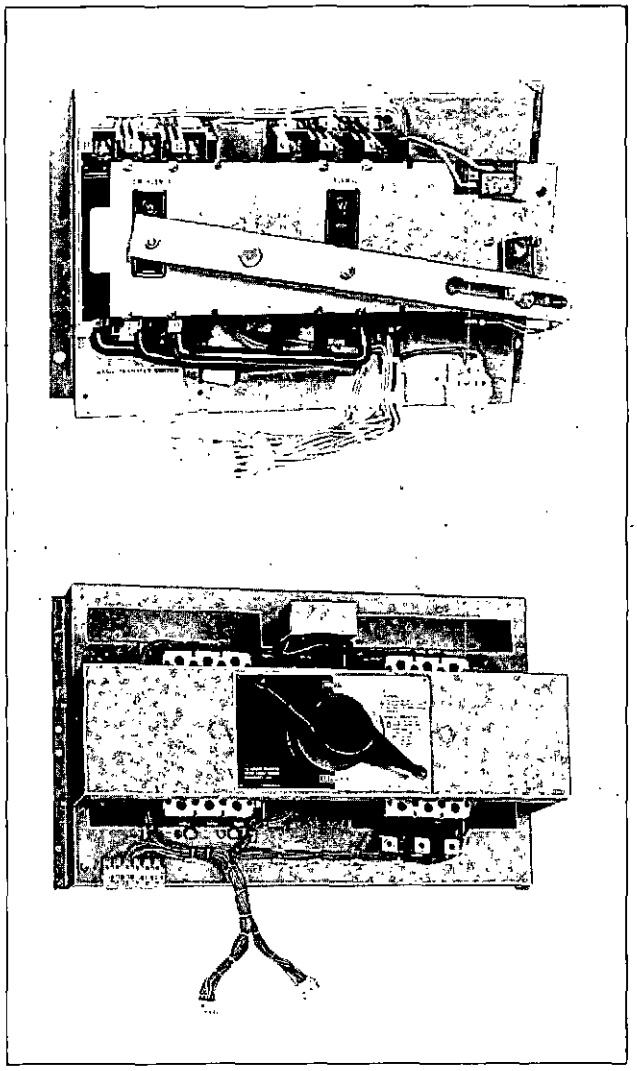
The Transfer Switch will operate to the emergency position. If Accessory 1 or 2, or both, are used, the transfer will occur after a time delay.

The Transfer Switch will operate back to normal after Accessory 3's time delay.

Accessory 4 allows the engine to continue to run for an additional unloaded running time.



Automatic Transfer Switch



Basic Transfer Switches

BE SURE THE TEST SWITCH IS RETURNED TO THE AUTO POSITION TO INSURE PROPER OPERATION.

TYPES OF SWITCHES

Transfer Switches are offered in four types:

1. Automatic Transfer Switches

Automatic transfer switches that automatically perform the transfer function.

They consist of three basic elements:

1. Main contacts to connect and disconnect the load to and from the sources of power.

2. Intelligence/supervisory circuits to constantly monitor the condition of the power sources and thus provide the intelligence necessary for the switch and related circuit operation.

3. Transfer mechanism to effect the transfer of the main contacts from source to source.

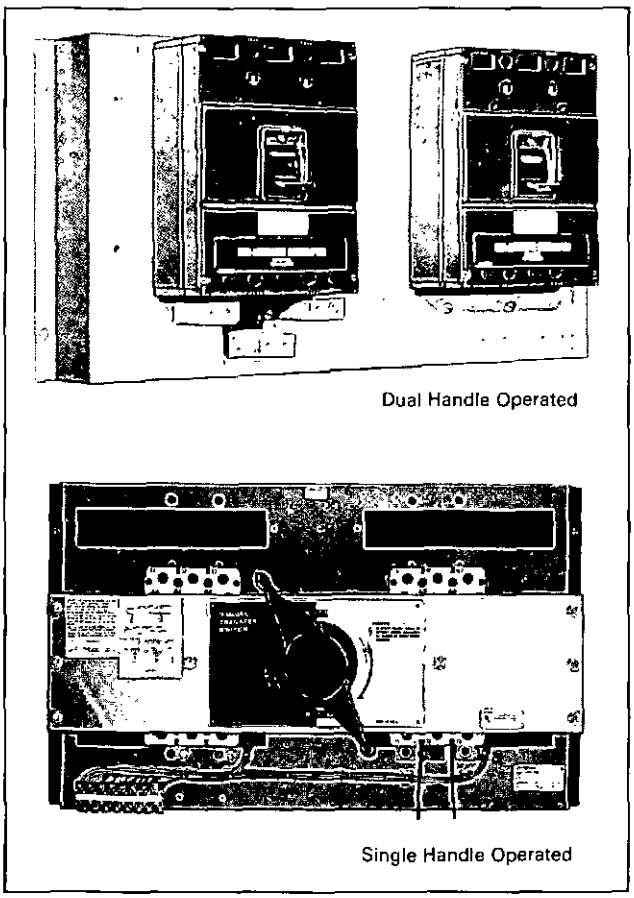
2. Basic Transfer Switches

This switch is designed for use with customer-furnished controls. The basic transfer switch is similar to the automatic transfer switch except that the intelligence circuit is omitted, thus all automatic sensing devices and relays are omitted.

Basic switches are UL, Inc., Component Listed. They can be applied up to 600 Volts Ac maximum and have an operating motor or coil at 120 Volts, 50/60 Hz.

3. Manual Transfer Switches

Manually-operated transfer switches are available with a single operating handle, Type MTSS, or the Type MTSD which is dual handle operated. Type MTSS utilizes a common operating mechanism with a single, free-wheeling handle mounted across the front of the two breakers for mechanically connecting and operating the individual breaker handles. With the Type MTSD, individual breaker handles are used for On-Off operation. Transfer of power is accomplished by true hand operation (not power assisted) with both types.



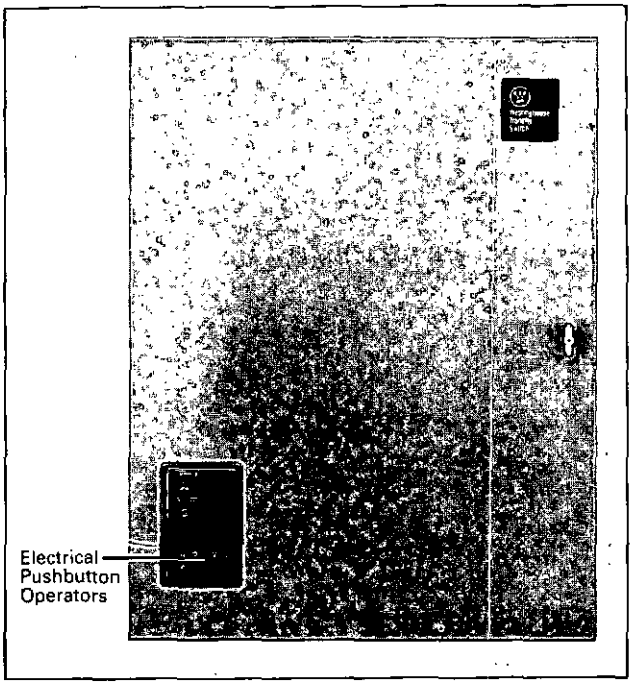
Manual Transfer Switches

Manual switches can be applied up to 600 Volts Ac maximum. All options selected are furnished suitable for use only on 120 Volt Ac, 50/60 Hz circuits. A control transformer is not furnished.

4. Non-Automatic Switches

This type of switch combines the electrical operation feature of an automatic transfer switch with manual transfer initiation feature of the manual transfer switch.

The switch electrically transfers power only when the appropriate pushbutton housed on the enclosure door is depressed by operating personnel. The switch is equipped with a control panel identical to the automatic transfer switch except the full-line voltage protection is omitted.



Non-Automatic Transfer Switch

Transfer Switch Catalog Number Explanation

Type Switch	Construction	No. of Switches Poles	Ampere Rating	Voltage	Enclosure
A TS Transfer Switch A – Automatic B – Basic M – *Manual or* Non-Automatic	B M BM – Automatic or Non-Automatic DM – Dual (2) Operating Handles SM – Single (1) Operating Handle	3 2 – 2 Pole 3 – 3 Pole 4 – 4 Pole	0225 0100 – 100 Amp 0150 – 150 Amp 0225 – 225 Amp 0300 – 300 Amp 0400 – 400 Amp 0600 – 600 Amp 0800 – 800 Amp 1000 – 1000 Amp	– A – 120/60 B – 208/60 W – 240/60 X – 480/60 E – 600/60 G – 220/50/60 M – 230/50 Z – 365/50 H – 380/50 N – 401/50 O – 415/50 K – 600/50	K K – Open S – NEMA 1 J – NEMA 12 R – NEMA 3R L – NEMA 4 D – NEMA 4X

TRANSFER SWITCH OPTIONS

Description

The following options are Underwriters' Laboratories, Inc. listed, except as noted, when supplied on UL Listed switches.

NOTE: If an option is selected that is NOT UL listed, the switch will NOT have a UL label.

1. Time Delay Normal to Emergency (TDNE)

Delays the transfer from normal in order to override momentary power outages/fluctuations. Timing begins when Emergency source appears. Does not affect initiation of engine start circuit. Should the Normal power source fail, the engine start contact will immediately close and, if connected to an engine generator, will initiate engine startup.

A. Adjustable 1-60 seconds.
B. Adjustable 0.1-10 minutes.
C. Adjustable 0.2-30 minutes.

2. Time Delay on Engine Starting (TDES)

This option is for use only where the Emergency source is an engine generator. It delays initiation of the engine start circuit in order to override momentary power outages or fluctuations. Does not affect ability of the switch to transfer from Normal to Emergency source.

B. Adjustable .5 to 15 seconds.
C. Adjustable 4 to 120 seconds.

3. Time Delay Emergency to Normal (TDEN)

Delays the transfer from emergency to permit stabilization of the normal power source before retransfer is made. Timing begins when the normal source appears. If the Emergency source fails during timing, transfer to Normal source is immediate, overriding the time delay.

A. Adjustable 1-60 seconds.
B. Adjustable 0.1-10 minutes.
C. Adjustable 0.2-30 minutes.

Description

4. Time Delay for Engine Cool-Off (TDEC)

Permits the generator to run under a no-load condition after transfer to Normal has been made. Timing begins when transfer is made.

A. Adjustable 1 to 60 seconds.
B. Adjustable 0.1 to 10 minutes.
C. Adjustable 0.2 to 30 minutes.
D. Fixed, non-adjustable, five (5) minutes.

5. Frequency/Voltage Relay for Emergency Source

Relay is connected to the Emergency source, constantly monitoring that phase. Prevents transfer from Normal to Emergency until the engine generator has reached its operating frequency or voltage. When switch is in the Emergency position and the Emergency source is outside the relay setting, the switch will initiate transfer to the Normal position if the Normal source is present.

A. Underfrequency, adjustable 45-60 Hz (drops out 2 Hz lower than setting).

B. Undervoltage/Underfrequency (combines 5A and 5D in single card except voltage non-adjustable).

C. Overfrequency, adjustable 50-65 Hz (drops out 2 Hz above setting).

D. Undervoltage, adjustable (nominally set at 90% pickup, 70% dropout). Single phase sensing only.

E. Overvoltage, adjustable (nominally set at 105% pickup, 115% dropout). Single phase sensing only.

F. Undervoltage, 3 phase, otherwise same as 5D.

G. Overvoltage, 3 phase, otherwise same as 5E.

Description

6. Test Pushbutton

Provides test operation of the transfer switch by simulating a loss of normal power. Engine starting will be initiated and transfer to Emergency source will occur. When selected, the standard two-position Auto/Test switch is omitted.

Momentary Contact (Pushbutton) (TPB)

B. In cover of enclosed switches.

7. Four-Position Selector Switch

Permits four modes of switch operation: "TEST", "AUTO", "OFF", and "ENGINE START". The "OFF" position de-energizes the control relays, opens the engine start circuit, and opens the motor circuit for maintenance or manual operation. The switch will not operate nor will the engine start on power failure. A white light is also furnished that lights only when the switch is in the "OFF" position.

The "TEST" position simulates power failure. Engine starting is initiated and the switch will transfer when emergency voltage appears. The "AUTO" position returns the transfer switch to Normal operation. The "ENGINE START" position retains the transfer switch at normal and initiates the engine start circuit. The switch will not transfer unless the normal source fails.

D. In cover of enclosed switch. When selected, standard two-position Auto/Test switch is omitted.

8. Bypass Pushbutton

Provides a bypass on the TDNE (Option 1) or TDEN (Option 3) relay, permitting switch to be transferred to Normal or Emergency source without time delay. Option is normally used in testing when it is not desirable to wait for the timers to finish their timing sequence.

C. Bypass TDEN (PBEN) in enclosure cover.
D. Bypass TDNE (PBNE) in enclosure cover.

9. Selector Switch Maintenance

Disconnects power to the transfer motor. Marked "OFF/AUTO". Subsequent manual operation of the transfer switch isolates the transfer switch load circuit from either source.

B. In cover of enclosed switches. (2-Pos. Sel. Switch)

Description

10. Preferred Source Selector Switch

For use when Normal and Emergency Source are both commercial power, or when the Normal Source is commercial power and the Emergency Source is engine generator. Option permits selection of either source as the preferred source to which the switch will always transfer, if that source is available. Marked Source 1/Source 2.

B. In cover of enclosed switch.

For use when Normal and Emergency Source are engine generators. Two engine start contacts are provided marked Source 1/Source 2.

D. In cover of enclosed switch.

11. Automatic Circuit Breaker Reset

This option provides means of resetting tripped thermal magnetic breakers when used in the transfer switch. Manual reset can be accomplished via the transfer switch manual operator.

D. Normal Breaker Reset PB in cover of Enclosed Switch.

E. Emerg. Breaker Reset PB in cover of Enclosed Switch.

F. Circuit Breaker Lockout: Prevents transfer if breaker trips (supplied as standard with Options 16/17/37).

12. Pilot Lights

Pilot lights can be furnished to indicate (1) switch position; (2) source condition; and, (3) tripped condition.

Switch Position: Utilizes a 1A breaker auxiliary contact.

C. Normal Supply (green) in cover of enclosed switch.

D. Emergency Supply (red) in cover of enclosed switch.

Source Condition: Indicates whether or not source voltage is present.

G. Normal Supply (white) in cover of enclosed switch.

H. Emergency Supply (white) in enclosure cover.

Tripped Condition: Available only with thermal-magnetic breakers, Option 16, 17, or 37.

Description

L. Normal Supply (amber) in enclosure cover.

M. Emergency Supply (amber) in enclosure cover.

14. Relay Auxiliary Contact

The Normal source relay is energized only when the switch is in the Normal position and Normal power is present. The Emergency source relay is energized whenever the Emergency source is present.

C. Normal Source: Provides 2 NO and 2 NC contacts.

D. Emergency Source: Provides 2 NO and 2 NC.

16. Thermal Magnetic Breakers in Place of Standard High Withstand Molded Case Switches

Use of this option can, in many cases, eliminate the need for separate upstream overcurrent/short circuit protection, thus enabling code requirements to be met with a device that takes up less space and requires less wiring. Either the Normal or Emergency breaker, or both, may be replaced. Four pole switches have trip units only in three poles. Includes Option 11F

A. Thermal Magnetic.

D. SELTRONIC® Circuit Breakers.

E. Thermal magnetic breaker, Emergency source only.

F. Thermal magnetic breaker, Normal source only.

17. High With Current Breakers in Place of Standard High Withstand Molded Case Switches (Includes Option 11F)

A. Thermal Magnetic Series C or MARK 75 Breakers.

B. SELTRONIC MARK 75 Circuit Breakers.

Description

18. Metering

E. Voltmeter mounted in cover (includes selector switch). Voltmeter is of direct reading type.

F. Ammeter mounted in cover (includes current transformers and selector switch).

G. Frequency Meter.

H. Running Time Meter.

19. Solid Neutral Bar Assembly

Provides insulated and groundable panel mounted neutral bar. Connections for Normal, Emergency and load. Shipped loose with open switches, mounted on enclosed switches. Neutral bar supplied as standard on automatic and non-automatic switches 2 and 3 pole.

20. Non-Standard Connections

Front connected solderless lugs are furnished on all enclosed units and on open units as standard.

A. Rear Bus Connections:

150-1000 Amperes – Non-Standard

21. Non-Standard Terminals (Refer to Westinghouse)

23. Plant Exerciser

Digital 7 day timer provides for automatic test operation of the plant for pre-selected intervals at least once a week, mounted on intelligence circuit. A 60 or 50 Hz unit is used depending upon frequency.

C. Without interrupting normal supply.
D. By simulation of power failure.
G. With a selector switch for choosing 23C or 23D.
I. Same as D except with fail-safe return to Normal should Emergency fail during exercise period.
J. Same as G except with fail-safe return to Normal should Emergency fail during exercise period.

24. Battery Charger

The trickle charge Dc output is 12 or 24 volts. Units are supplied in separate wall mounted enclosure. Automatic high-low charge rate.

C. 12 volt
D. 24 volt
E. 32 volt

26. Type of Protection (Normal Source)

Complete protection is standard. A voltage sensing relay monitors each phase of the Normal power supply. Normally set at 70% dropout and 90% pickup.

C. Overvoltage Sensing Relay-adjustable, nominally set at 105% pickup and 115% dropout (normally used with Option 26A).

D. Area protection connections with override circuit. Provides two terminal blocks for connection of one or more NO (open when there is no voltage) area protection contacts; these terminal blocks are wired in the same manner as the test switch and when the NO area protection contact opens, the switch will initiate engine start and will transfer to Emergency. In the event that the NO area protection contact remains open and the Emergency source fails when the switch is in the Emergency position, an override circuit will retransfer the switch to the Normal source if it is available.

E. Underfrequency, adjustable 45-60 Hz (drops out 2 Hz lower than setting). A frequency sensing relay is connected to 1 phase only of the Normal source, constantly monitoring that phase.

F. Overfrequency, adjustable 50-65 Hz (drops out 2 Hz above setting). A frequency sensing relay is connected to 1 phase only of the Normal source, constantly monitoring that phase.

27. Non-Standard Voltages and Frequencies

A. Non-standard AC voltages and frequencies.

Three and four pole breaker type switches are suitable for use on 208, 220, 240, 380, 415, 480 and 600 volts, 50/60 Hz without modification through the use of multi-tap transformers. VSR adjustment capability make switches suitable for use on 230, 365 and 401 volt, 60/50 Hz systems (when used on these voltages, the dropout voltage is set at 75% instead of 70%).

28. Intelligence Circuit Fuses

A. Provides fuses on all non-essential control circuitry.

29. Type of Operation

Automatic operation is standard. Provides for automatic transfer and retransfer from source-to-source as dictated by the reset values of the transfer switch intelligence circuits.

D. Pushbutton operation only. Includes two pushbuttons (marked NMPB and EMPB) for operating the transfer switch from Normal to Emergency and from Emergency to Normal. No automatic operation is included. Note: This option is standard on non-automatic units (catalog numbers MTSBM).

E. Pushbutton return to Normal. Automatic operation Normal to Emergency, pushbutton operation Emergency to Normal.

①G. Automatic/Manual operation. Two position selector switch (marked Auto/Manual) permits selection of automatic or manual operation. Includes Option 29D which is functional only when selector switch is in the manual position.

J. Automatic/Manual pushbutton return to Normal. Two position selector switch (marked Auto/Manual) permits selection of automatic or manual pushbutton return to Normal. Includes Option 29E which is functional only when selector switch is in the manual position.

① Not UL Listed.

Description

30. Cranking Limiter

A. Adjustable 20-200 seconds. Interrupts motor start circuit if voltage does not appear within pre-selected time.

31. Audible Alarm with Silencing Switch

Sounds alarm when switch is in the Emergency position and Emergency voltage is present.

B. Enclosure mounted.

32. Delayed Transition Timer

Provides a time delay in the Neutral (both off) position when the load is transferred in either direction to prevent excessive inrush currents due to out-of-phase switching of large motor loads. Utilizes a 1A Breaker auxiliary contact.

A. Adjustable .5 to 50 seconds.

33. Shunt Trip

Wired to terminal blocks for customer connection. (120V coil supplied as standard.)

A. Supplied in Normal Breaker.

B. Supplied in Emergency Breaker.

34. Extender Cable

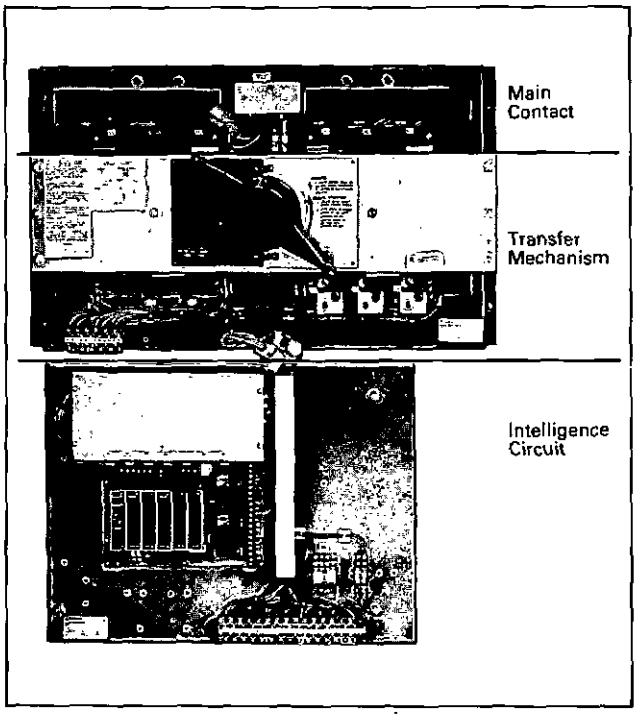
Provides a means for extending the distance between the power switching panel and the intelligence panel. This allows for remote mounting of the intelligence panel.

A. 42 inch.
B. 72 inch.
C. 96 inch.
D. 120 inch.
E. 144 inch.

Special lengths are available. Contact Westinghouse.

35. Pretransfer Signal Device

A. Provides contacts for interface with other equipment (typically elevator controls) prior to transfer in either direction.



Transfer Mechanism

37. Service Entrance

A. Provides transfer switch as suitable for service equipment rating. A key operated selector switch permits external, power operated service disconnection with external pilot light for disconnect indication, also includes Option 16 or 17.

B. Same as A except, includes ground fault protection.

MAIN CONTACT, INTELLIGENCE AND TRANSFER SYSTEMS

The automatic transfer panel consists of three main elements: the main contacts, the intelligence circuit, and the transfer mechanism as shown. Components comprising these systems are installed in accordance with the specific requirements of the circuit being controlled. Each panel is therefore tailor-made for a specific control function. Following is a description of the principal components of the main contact, intelligence and transfer mechanism.

1. High withstand, molded case switches are the main contacts for the Normal and Emergency power sources in standard, unmodified switches (Option 16 or 17 are not selected). These continuous duty switches are rated for all classes of loads, open or enclosed; they have high dielec-

tric strength, heavy-duty switching and withstand capabilities, and high interrupting capacity. They incorporate positive, quick-make, quick-break toggle mechanisms and De-ion® arc quenchers.

2. The intelligence circuit consists of timing and voltage sensing elements connected to the power sources and provides the signals necessary for switch operation.

3. The transfer mechanism transfers between power sources through a motor-driven gear train that operates cams to open and close the normal and emergency switches. The mechanism provides a positive mechanical interlock which prevents both switches from being closed at the same time.

TROUBLESHOOTING

The Transfer Switch is energized; proceed with care!

A. Gen-Set Does Not Start When Test Switch is Operated

1. *Check Operation.* Make sure switch is held in "Test" position longer than the Option 2 time delay.

2. *Check Engine Controls.* Make sure control is in "Automatic" position. Make sure batteries are charged and connected. Make sure engine start circuit is wired.

3. *Check Wiring.* Make sure the start signal wires from the engine controls are connected to the correct terminals on the Control Panel. See the Schematic/Wiring Diagram.

4. *Check Signal Circuit.* Disconnect and tape start signal wires. Connect ohmmeter between terminals 51 and 52. Reading should indicate an open circuit. Depress and hold Test Switch. After Option 2 times out, ohmmeter should indicate a closed circuit.

B. Transfer Switch Does Not Retransfer the Load After Normal Source is Returned or After Test Switch is Released

1. *Check Operation.* Make sure time has passed to allow for Accessory 3 time delay.

2. *Check Normal Source Voltage Levels.* On a three phase system voltmeter should read phase-to-phase voltage. LED on Normal Source monitoring card should be on.

3. *Check Signal Circuit.* Confirm that the Test Switch has closed by checking continuity between terminals 60 and 61.

C. With Gen-Set Running, Transfer Switch Does Not Transfer the Load to Emergency

1. *Check Operation.* Make sure time has passed to allow for Option 1 time delay.

2. *Check Engine Contols.* Check generator output frequency and voltage. Output should be at least 90% of nominal voltage and 95% of nominal frequency. Make sure generator output circuit breaker is closed. LED's on emergency source monitoring cards should be on.

3. *Check Wiring.* Voltmeter should read phase-to-phase voltage between Transfer Switch terminals E1 and E2.

D. Transfer Switch Retransfers the Load, but Gen-Set Continues to Run

1. *Check Operation.* Make sure time has passed to allow for Option 4 time delay.

2. *Check Engine Controls.* Make sure engine starting control is in the "Automatic" position.

3. *Check Signal Circuit.* Disconnect and tap wires to terminals 51 and 52. Connect ohmmeter between these terminals; reading should indicate an open circuit.

If the problem is isolated to the transfer mechanism, main contacts or signal circuits on the Control Panel or the Transfer Switch, call your local Authorized Representative for further assistance.

OPERATION OF THE TRANSFER MECHANISM

The operating principle of all transfer switches is the same. However, switches rated 100 amperes employ a different mechanical system for the switching operation than the gear-train system used in 150 to 1000 ampere units. The transfer mechanism of the 100 ampere unit, Fig. 1, consists of a pivoting rocker-arm lever which operates the circuit breaker handles as the arm is moved by a rotating lever connected to the transfer motor. A slide pin engaging a pivot in the rotating lever converts rotary motion to linear motion. Motor limit switches for these units are mounted external to the molded case switches and operated by the rotating lever. Each limit switch is synchronized with its associated switch to operate when its switch closes.

The transfer mechanism of 150 to 1000 ampere units, Figs. 2 and 3, consist of a unidirectional gear motor, one drive gear, two spur gears and cams assembled in a housing located directly in front of the circuit breakers. The handles

of the switches fit into the two cams located on both sides of the central drive gear. In operation, after the emergency power source appears and the voltage supplied by that source is sufficient, the ER relay closes. This closure completes the circuit to the transfer motor. The motor turns the central drive gear, opening the normal switch and closing the emergency switch. The closing of the emergency switch opens an auxiliary contact that cuts off power to the transfer motor, and a built-in solenoid brake provides positive stopping of the motor as soon as power to it is cut off. When normal power returns, the NR relay completes the circuit that opens the emergency and closes the normal switch. On closing, the normal switch operates a contact that stops the motion of the transfer motor.

The drive for the transfer mechanism is provided by a center spur gear powered by a unidirectional motor. The center gear drives two outer spur gears, each of which have a steel shoulder screw and nylon roller positioned to engage a groove in a nylon cam and thus operates both molded case switches. The nylon rollers are mounted eccentrically on each of the outer spur gears, which drives its associated cam. The cams travel vertically on guide rods attached to the mechanism's housing. (See Fig. 3.)

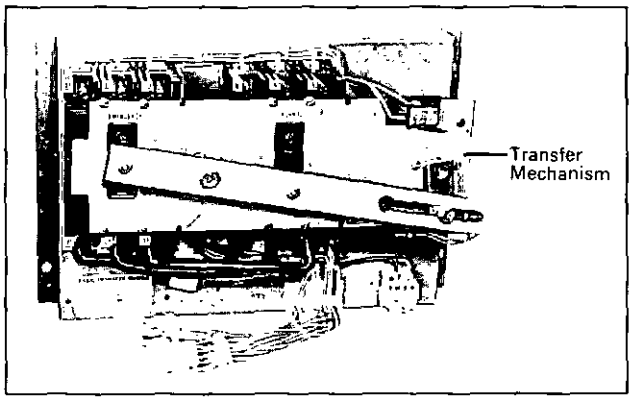


Fig. 1 *100 Amp Power Panel*

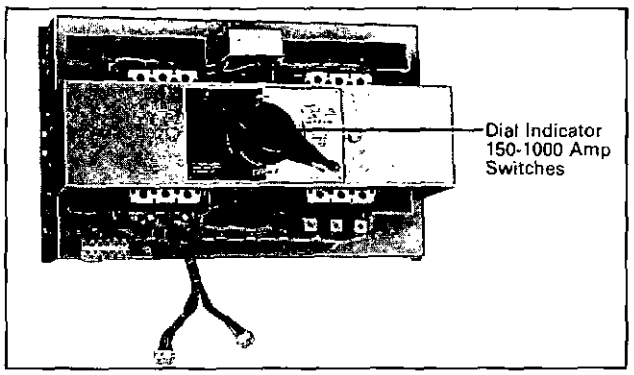


Fig. 2

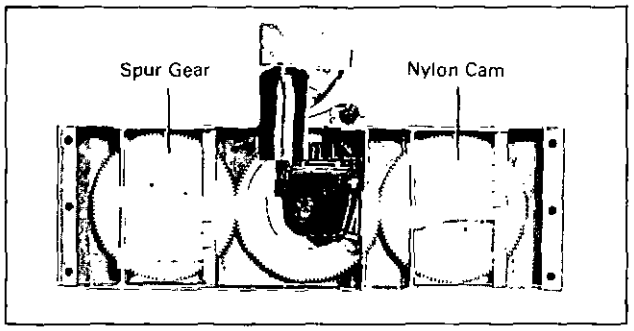


Fig. 3 *Transfer Mechanism 150-1000 Amp*

NOTE: On transfer switches 150-1000 amp and larger, a dial on the mechanism front indicates which position the switch is in. The handle free-wheels, thus does not indicate switch position.

All transfer mechanisms employ a mechanical interlock to prevent both breakers from being closed at the same time. This feature keeps the molded case switches trip-free in the closed position and thereby permits thermal and short circuit protection to be incorporated in either or both interrupters. If thermal and magnetic trips are required, the interrupter is supplied with a built-in contact which opens only when the interrupter trips on overload or short circuit. This prevents further electrical automatic operation of the switch until the fault is cleared and the interrupter reset.

The power for all transfer mechanisms is taken from the side to which the load is being transferred. The normal power source is the preferred source and the switch will always seek this source when it is available.

This design permits:

(a) Two Electrically Operated Positions;

(1) Normal switch closed – emergency switch open.

(2) Normal switch open – emergency switch closed.

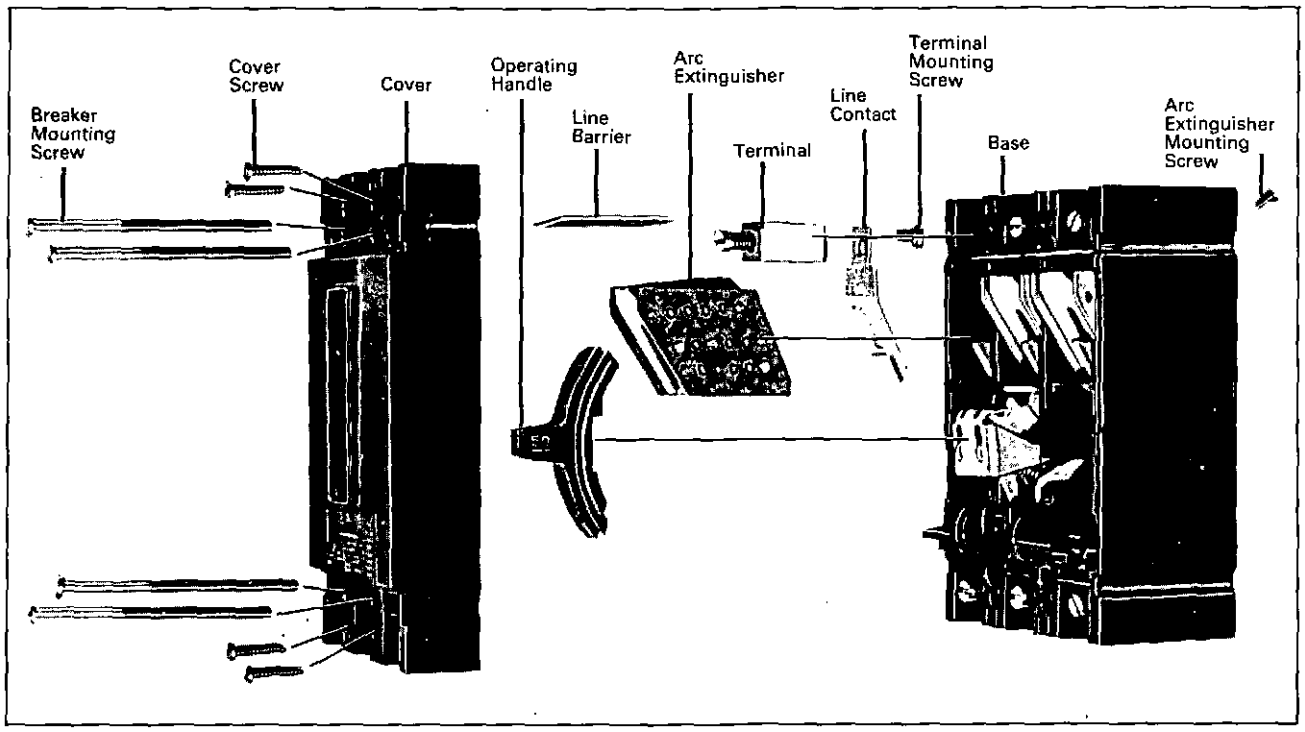
A neutral position (i.e., both switches off together) is not possible if any power source is available. Unless Option 32A is selected.

(b) Three Manually Operated Positions;

(1) Normal switch closed – emergency switch open.

(2) Normal switch open – emergency switch closed.

(3) Both switches open (this position is only possible when the transfer motor is disconnected).



Manual Operation

Should manual operation be required, first isolate the transfer motor circuit by unplugging the disconnect link. Any attempt to operate the manual handle without first isolating the transfer motor circuit will cause an automatic transfer cycle to the preferred power supply, if available.

100-Ampere Switches

To operate manually and to disconnect the motor circuit, unscrew the rotating lever slide pin in the rocker arm lever and remove. Pivot the rocker arm lever until the desired position is achieved. No special tools are required. The rocker arm lever nameplate indicates switch position.

NOTE: The slide pin is a left-hand thread. Remove by unscrewing clockwise.

150-1000 Ampere Switches

Rotate the black handle in a counterclockwise direction until the desired position is reached. The nameplate has an indicator or flag that shows switch position. The handle free-wheels in the clockwise direction so that if electrical operation occurs the handle will not rotate.

To disconnect motor circuit:

Unplug the motor disconnect plug located to the transfer motor. Or, if the unit is supplied with 4 position selector switch (opt. 7D), it should be turned to the "OFF" position (in these cases it is not necessary to unplug the disconnect link). Any attempt to operate the handle without first isolating the transfer motor causes an automatic transfer cycle.

Please refer to the factory (800-354-2070) for a tabulation of replaceable items. **Transfer mechanism parts and circuit breakers replaced by other than an authorized Westinghouse representative is not recommended.**

MAINTENANCE

The transfer switch is maintenance free under normal usage. Local conditions, however, may make it necessary to periodically blow dust and dirt from the relays and timers, and to see that grease or oil do not accumulate on the switch components.

Follow the recommendations of the generator set manufacturer as to testing frequency. Use test switch to check the electrical operation of the switch. **Always return the switch to the Auto position when the test is completed.**

The enclosure door should only be opened by a competent electrician familiar with the transfer switch.

Good maintenance procedure calls for periodic inspection of all electrical apparatus including molded case switches. Terminal lugs and trip units must be tight to prevent overheating. Due to the inherent wiping action

built into the moving contacts of all circuit breakers, operating the switch several times under load will remove any high resistance film that may have formed.

Under normal conditions, additional cleaning of contacts is not required. However, should operating and/or atmospheric conditions make it desirable to clear the contacts further, the following procedure is recommended:

1. Remove cover, arc extinguisher hold down screws, arc extinguishers, and line terminal assemblies.

2. Wipe contact surfaces with a clean cloth dipped in carbon tetrachloride or other chlorinated solvent. If surfaces are excessively oxidized or corroded, scrape lightly with a fine file before wiping.

The manual operating handle is fit to its bushing with a **left hand** thread. Should it ever become necessary to dismantle this mechanism, it is essential on re-assembly that the cam-operating rollers on the outer gears be positioned precisely by meshing the outer gears in the correct relationship to the drive gear. Lines are scribed on both the drive and outer gears to facilitate alignment. (See Fig. 3.) In refitting the transfer assembly back into position, the right and left circuit breaker handles must fit into position between the rollers operated by the cams and outer gears.

The intelligence circuit can be electrically isolated by disconnecting plugs P1 and P2. Be sure to place the engine controls in the OFF position first to avoid an inadvertent engine start.

The switch can be manually operated by either removing the disconnect plug (P4) or plugs P1 and P2.

CAUTION

The mechanism and molded case switches should not be serviced by other than an authorized factory representative.

SEQUENCE OF OPERATION

Under normal conditions, the right hand or normal switch is closed and the left hand or emergency switch is open. The 3 phase voltage sensing card (UV) and the normal control (NR) relay are energized. Should the normal power fail, the (UV) card drops out, and in so doing provides a signal to start the engine generator. When the generator provides sufficient voltage, the ER relay closes and completes the circuit to the transfer mechanism. This action opens the normal switch and closes the emergency switch. The closing of the emergency switch opens the auxiliary (ELS) contact which stops power to the motor operating the transfer mechanism. Positive stopping of the motor is achieved by a solenoid brake.

When normal power returns and the voltage reaches the UV card's pickup point, the NR relay closes initiating engine generator shutdown. The closing of the NR relay completes the circuit to the transfer mechanism, opens the emergency switch, and closes the normal switch. Once the normal switch is closed, an auxiliary (NLS) contact inside the switch cuts off power to the transfer mechanism motor and normal conditions within the switch are fully restored.

Transformers NT1 and ET1 are multi-tap units with primaries for 600, 480, 240, 208, 230, 380 or 401/416 volt connections. The NT1 transformer is connected to one phase of the normal supply and the ET1 transformer is connected to one phase of the emergency supply. NT1, ET1 tranformers have two electrically separate windings, each with 120 volt output. The smaller winding (25VA) supplies power to the solid-state control and the larger secondary supplies power to the transfer motor and solenoid brake circuit.

Intelligence Circuit

The intelligence circuit is mounted on the lower panel and is connected to the switching panel (upper) by means of a cable terminating in two plugs, keyed to prevent improper insertion. An extender cable is offered if it is desired to mount the intelligence circuit a greater distance away from the switching panel than the standard cable allows; or, if an even greater distance is desired, male and female plugs are offered to allow customers to fabricate cables to their specific requirements. The intelligence panel can be mounted in any position.

Intelligence panels come in one size regardless of the type of switch and the number of options. The panel is drilled and tapped for the maximum number of options that can be installed on it.

All intelligence panels have two power transformers (one for normal, one for emergency source) and one logic transformer package (for monitoring both sources).

A solid-state logic package consisting of six or nine plug-in printed circuit cards is also mounted on the panel. A plug-in relay is used for outputting from the logic package.

Options 1, 3, 4, 5, 26 are performed by printed circuit cards. Four timing cards (1-60 sec., 0.1-10 minutes,

0.2-30 minutes, and 5 minutes fixed) are used interchangeable in Options 1, 3, 4; cards for undervoltage, overvoltage, underfrequency and overfrequency are used interchangeable in Options 5 and 26. Options 2, 23, 30, 32, and 35 are performed by panel mounted timers.

NOTE: When Option 4 is selected, upon initial energization of the transfer switch, an Engine Start will be called for until the time setting has elapsed. To avoid this, put the Engine Start panel in the "OFF" position for this period of time. This will only occur on the initial energization.

Each plug-in card has adjustment knobs that can be screwdriver or finger adjusted. In addition, each card has a captive, screwdriver lock that positively locks the adjustment setting by providing an even, uniform force that does not alter the setting when it is tightened. Voltage cards and frequency cards are interchangeable, as are timing cards; however, a timing card cannot be used in a voltage/frequency slot, or vice versa, since they are key interlocked to prevent improper insertion. Each card is held in place by two captive screws. Empty card slots are covered by blank covers.

Each logic package is divided into sections for Normal source and Emergency source. Each source is further subdivided into sections for Voltage/Frequency and Timing. The standard catalog numbered switch without options has two driver cards (one in the Normal and one in the Emergency timing slot) which are required for operation. If timing options are selected, the drivers are omitted since either a driver or a timer is required on both the Normal and Emergency sources for operation.

A Light Emitting Diode (LED) is supplied on each sensing or time delay card. The light appears on the sensing card (voltage or frequency) when the monitored voltage or frequency is within the preset limits. The light appears on the time delay cards after the preset time has elapsed. In other words when the card has "picked-up" the light is on.

Voltage signals from the logic packages terminals 1 thru 7 provide normal source voltage to the undervoltage card (UV). If this voltage is within the cards dial settings it will then signal the TDEN relay to begin timing. Upon completion of its time delay as set on the dial it will then energize the Normal relay (NR) and the TDEC card. Upon completion of its time delay the TDEC will drop out the EC relay and open the engine start circuit shutting down the engine.

Correspondingly, terminals 8 thru 10 monitor one phase of the emergency source. Proper input to the UF card will cause it to energize the relay driver card and this card will energize the ER relay.

The normal and emergency relays (NR and ER) can be energized simultaneously.

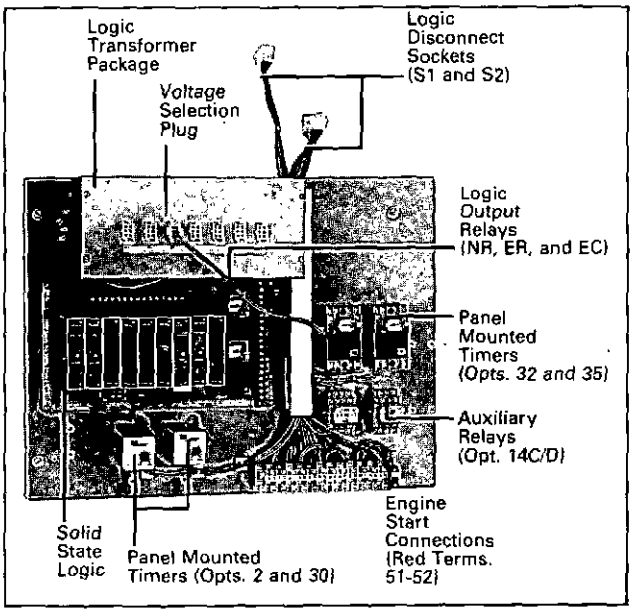
Also should a source of power disappear the switch will automatically override any option 1 or 3 time delay functions and, if necessary, immediately transfer to the available source.

STORAGE

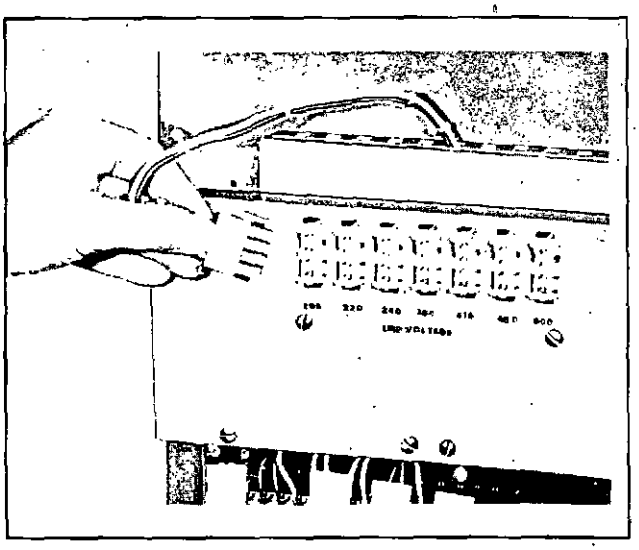
If the transfer switch is to be stored prior to installation, it should be ordered with packaging/crating suitable for the storage environment both mechanically and environmentally. This is equipment not designed or packaged for outdoor storage and warranty will be withdrawn upon evidence of extended outdoor storage. It is strongly suggested that this equipment be stored in a climate controlled environment between the limits of −20°C to 85°C with a relative humidity of 80% or less.

ADJUSTMENTS

All Automatic Transfer Switches are furnished with an adjustable line voltage plug and receptacles. To change line voltage, remove the covers and insert the plug in the desired receptacle (see illustration). Replace the covers.



Solid-State Intelligence Panel



Line Voltage Plug and Receptacles

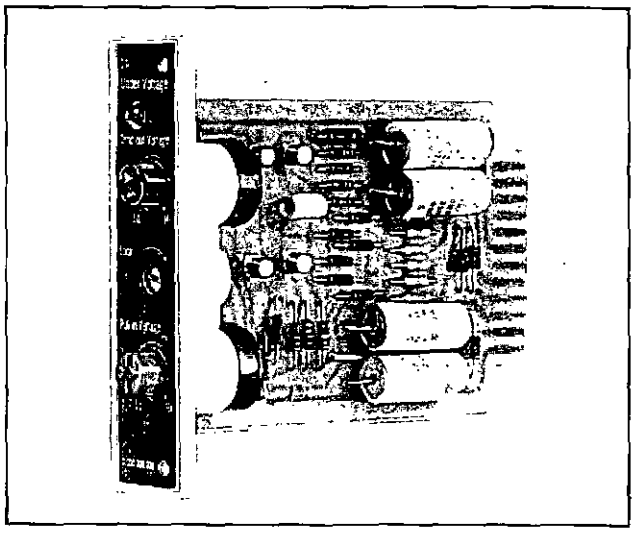
CAUTION

Be sure the plug is inserted in the receptacle corresponding to the system voltage. Improper connection can cause damage.

OPTION ACCESSORY ADJUSTMENTS

Devices such as voltage sensing relays, timers, etc. furnished with transfer switches will be similar to one of the following types of devices and adjustments should be made as shown for that type of device.

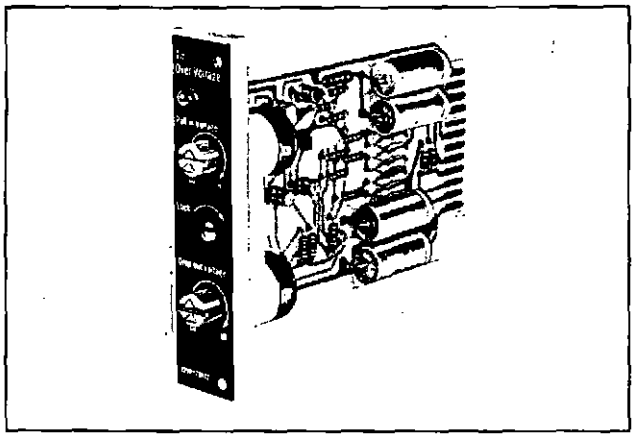
Solid-State Logic Cards



Undervoltage Card – Used on Option 5D and Standard for Normal Side Sensing

NOTE: Adjustments to sensing cards (voltage and frequency) require a variable source of control power. DO NOT ATTEMPT to adjust these cards without such variable control power. Westinghouse offers a compact, field test kit S/N 1278C67G01 for accurate field adjustments of sensing cards. Refer to the factory for availability.

Step	Description
1	Set Drop-out knob maximum Counterclockwise
2	Set Pick-up knob maximum Counterclockwise
3	Increase line volts to desired Drop-out value (normally 70%) LED should be "ON"
4	Rotate Drop-out Clockwise until LED goes "OFF"
5	Rotate Pick-up to maximum Clockwise LED is "OFF"
6	Increase line volts to desired Pick-up value (normally 90%) LED is "OFF"
7	Rotate Pick-up knob Counterclockwise until LED comes "ON"
8	Recheck Pick-up and Drop-out by running voltage up and down check by LED indication



Overvoltage Card – Used on Options 5E, 26C

Step	Description
1	Set Drop-out to maximum Counterclockwise
2	Set Pick-up to maximum Counterclockwise
3	Set line voltage to pull-in value desired (normally 105%) LED is "OFF"
4	Rotate Pick-up Clockwise until LED comes "ON"
5	Rotate Drop-out maximum Clockwise
6	Set line voltage to Drop-out value desired (normally 115%)
7	Rotate Drop-out Counterclockwise until LED is "OFF"
8	Drop line voltage to pull-in desired value. LED should come "ON"
9	Increase line voltage to desired Drop-out value. LED should go "OFF"

Time Delay Cards

Used on Options 1A, 1B, 1C, 3A, 3B, 3C, 4A, 4B, 4C, 4D

Four cards are available; they are interchangeable and can be used in any timing slot.

1 – 1-60 sec.
2 – 3 sec.-10 min.
3 – 10 sec. to 30 min.
4 – 5 min. fixed

Frequency Sensing Cards

Used on Options 5A, 5C

Both under and overfrequency cards are factory calibrated at 60 Hz. The actual values of pick-up and drop-out are as follows:

Type	Dial Setting Hz	Pick-up Hz	Drop-out Hz
Underfrequency	60	57	55
Underfrequency	50	47	45
Overfrequency	60	63	65
Overfrequency	50	53	55

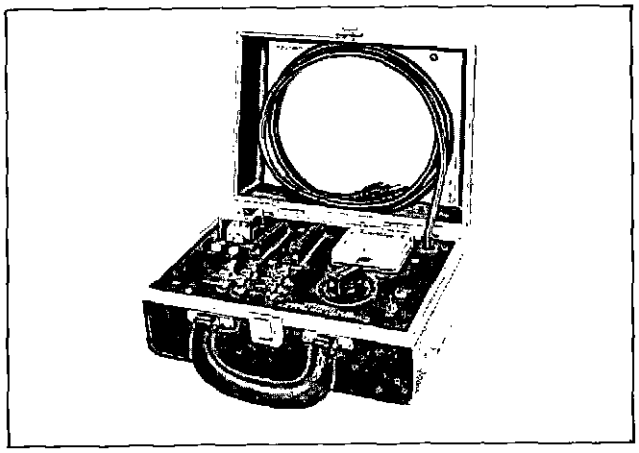
The adjustment dial is continuously variable between its limits.

All Cards Mechanically Interlocked

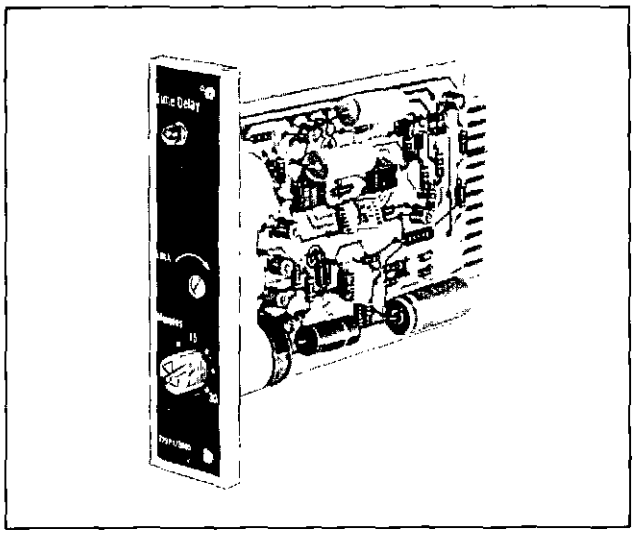
All cards are interlocked mechanically to prevent insertion into the wrong function slot. All cards have a repeat accuracy over a 20 to +60°C temperature change of ±3%. Dial settings are ±10% of indication.

After making adjustments, tighten locking screw to secure setting. Tighten mounting screws (screws are not captive).

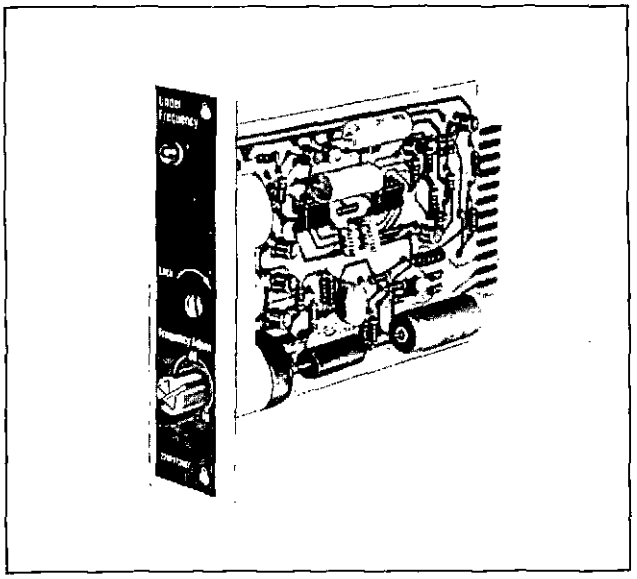
Portable Test Kit



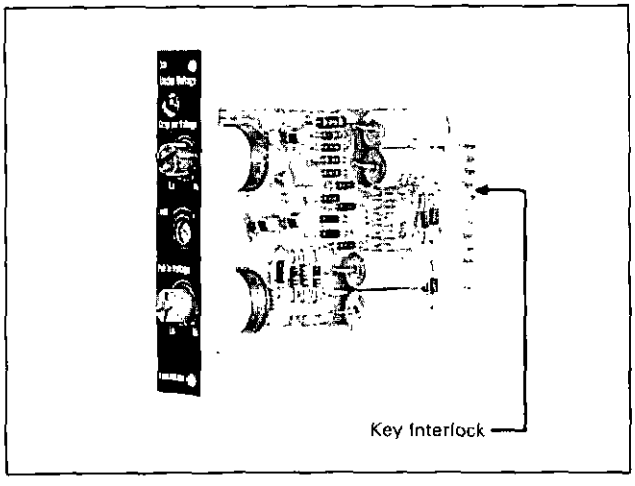
Portable Test Kit



Time Delay Card



Underfrequency Card



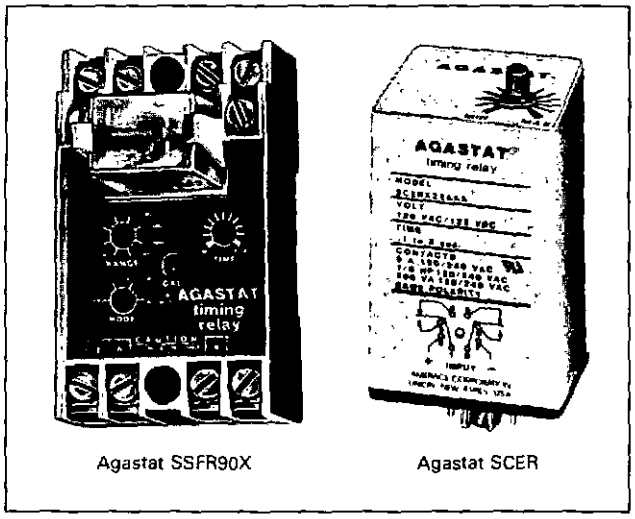
An inexpensive, portable test kit, S#1278C67G01, is available for convenient field testing and calibration of all plug-in cards and output relays. The only power source required is a 120V convenience outlet. A selector switch allows the operator to test individual cards or to simulate ATS operation by having the source monitoring cards drive the time delay cards which in turn drive the output relays, exactly as in actual use. Calibration checks or changes can thus be accomplished without the necessity of energizing the alternate power source.

Off Delay Timing Relay

Off Delay Used on Options 2, 30 (SCER)

When the relay coil is energized, the relay contacts pick up immediately. Upon deenergization, a time delay will occur before the relay contacts drop out. The time delay is adjustable by rotating the dial.

Panel Mounted Timing Relays



Agastat SSFR90X Agastat SCER

Panel Mounted Timing Relays

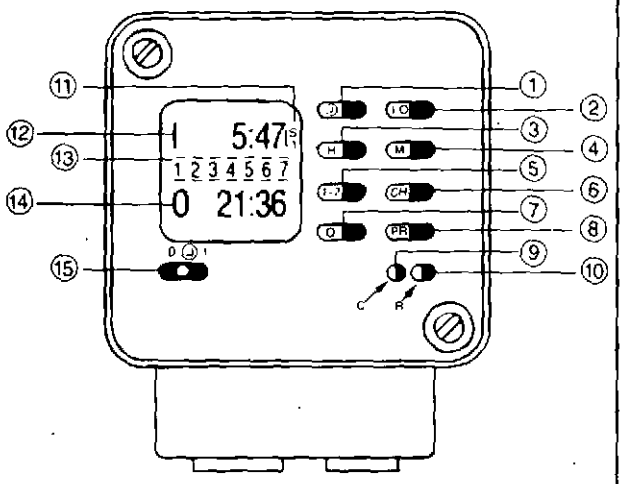
On Delay Used on Options 32, 35 (SSFR90X)

When the relay coil is energized, a time delay will occur before the relay contacts pick-up. Upon de-energization, the contacts drop-out immediately. The time delay is adjustable by setting both the range and time dials. See separate instructions for setting timer included with wiring information.

NOTE: This is a universal timer which must always be set in the ON DELAY mode for proper operation.

Plant Exerciser Timer

Plant Exerciser used in Option 23. This is a seven-day timer switch used to exercise the engine-driven generator.



(1) Clock Mode — For setting time and day of week

(2) I/O — For programming "ON" and "OFF" cycles
I — Programs "ON" time
O — Programs "OFF" time

(3) Hours Setting

(4) Minutes Setting

(5) Day of Week Setting

(6) Checks programs successively which have been entered into the time switch

(7) "Q" Button — Enters days of the week to be programmed

(8) Program Button

(9) Clears selected programs, during or after program is entered

(10) Reset — Resets everything in memory, including time of day and all programs

(11) Output Energized Indicator

(12) Displays "On" Time

(13) Day Indicator

(14) Displays "Off" Time

(15) Output Switch — Program mode and output override
(J) : In Program Mode
1 : Output Energized
0 : Output De-energized

Plant Exciser Timer

Setting Time of Day:

1. Push Reset Button [R] to clear all memory.
2. Press the Clock Button (J) the display should read 0:00.
3. Press the [H] button to set the hour of day.

NOTE: Time is set in 24 hr. (military) time.

4. Press the [M] button to set the minutes of the hour.
5. Press the [1-7] button to select the day of week. Either Sunday or Monday can be designated as Day 1.
6. Press the Program Button [PR] to enter the time. The points between the hours and minutes will begin to flash.

Programming:

A. How to Set the Turn ON Time

1. Slide the Output Selector Switch to the clock or program mode.
2. Press [I/O] Button. (This button programs the ON and OFF times.) A logic symbol "I" will appear in the top display window. "I" is the symbol for "ON".
3. Press the [H] Button to set the hour of the day the program will start or "Turn ON".
4. Press the [M] Button to set the minute of the hour the program will start.
5. Pressing the [1-7] Button advances the day marker from 1-7 and back to 1. For each and every day to be selected, press the [Q] Button when the marker is over the desired day.

B. How to Set the Turn OFF Time

1. Press the [I/O] Button. A logic symbol "O" will appear in the bottom display window. "O" is the symbol for "OFF".
2. Press the [H] Button to set the hour and the [M] Button to set the minute, the program will end or "Turn OFF".
3. Press the [1-7] Button. For each and every day to be selected, press the [Q] Button when the marker is over the desired day.

4. To enter the "complete program" (Turn ON and Turn OFF times) press the Program [PR] Button. The display will return to the present time of day.

5. Repeat for all other "complete programs".

NOTE: A maximum of 10 "complete programs" may be entered into the 1100 Series. When the memory has reached its capacity, the display will read "FULL".

6. Leave Output Switch (15) in the (⌟) program mode to activate the P.E. time sequence. The I output energized position will cause a continuous engine condition. The O output de-energized position will bypass the exercise program entirely.

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