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B15A01SE



**Cutler-Hammer**
Pittsburgh, Pennsylvania

Publication No. B.15A.01.S.E.
October 1998
Printed in U.S.A. / TSG 2620

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TRANSFER SWITCHES

# CLOSED TRANSITION IQ TRANSFER FOR AUTOMATIC TRANSFER SWITCHES


Cutler-Hammer

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# Transfer Switch Equipment

## *INTRODUCTION*

The Closed Transition IQ Transfer (CTIQ Transfer) is a programmable, microprocessor based monitoring device designed for use in Cutler-Hammer Closed Transition Transfer Switches (CTVI/CBVI). By using the Cutler-Hammer CTIQ Transfer, the user may avoid intentional interruption of power when both sources of power are available. This make-before-break mode of operation is useful during testing of the engine generator under load and where a predetermined Transfer to the generator is desired. Source paralleling duration is limited to less than 100msec.

## *PASSIVE CLOSED TRANSITION*

The Closed Transition mode of operation requires that both power sources be synchronized in voltage, frequency and phase angle within prescribed limits. Cutler-Hammer's CTIQ Transfer utilizes a technique that involves waiting for synchronization of the two sources without actively controlling the generator's voltage or frequency. The mode of operation is anticipatory in that the switch close command is initiated before the sources are exactly in-phase. Utilizing the phase angle and frequency difference between the two sources, a calculation is made to predict when both sources would be in phase. The response time of the switch is then factored in to determine when the switch close signal should be given to assure optimal closure of the two sources in-phase.

The Cutler-Hammer Closed Transition IQ Transfer must be selected with one of two feature sets: 47C or 47D. The difference between these two feature sets is the action taken by the CTIQ Transfer if it is determined that the two sources will not achieve synchronization. If Feature set 47C is selected, failure to synchronize results in the switch reverting to an Open Transition mode of operation. However, if Feature set 47D is selected, failure to synchronize will result in the CTIQ Transfer refusing to Transfer to Source 2 and an alarm signal being activated. In neither case will there be a paralleling of sources if synchronization is not achieved.

## *APPLICATION CONSIDERATIONS*

- *The generator used with a closed transition transfer switch must be equipped with an isochronous governor.*
- *When paralleling sources, fault current contributions from both sources should be considered in the system design*
- *Closed Transition (make before break) Technology causes paralleling with the utility. It is the user's responsibility to comply with any requirements regarding protective relaying. Protective relaying is not supplied with the standard transfer switch, but is available.*

# Switch Application Section

## *CUTLER-HAMMER CLOSED TRANSITION IQ TRANSFER FEATURES*

The CTIQ Transfer is a door-mounted, totally enclosed device that is customer accessible from the Transfer switch front panel.

Data access and programming operations are performed using the CTIQ Transfer's touch-sensitive function buttons in conjunction with an easy-to-read, illuminated, alphanumeric LED display. Both the function buttons and the display window are part of the device's front panel. A built-in Help button provides user assistance in the form of message displays.

The CTIQ Transfer is communications ready and compatible with all Cutler-Hammer IQ devices as well as the Cutler-Hammer IMPACC Series III system-wide supervisory and control software. This permits monitoring and control of several transfer switches, locally or remotely, from a single point.

## *ADDITIONAL FEATURES:*

- Source Paralleling duration is limited to 100msec or less.
- Applicable for use on any Low or Medium Voltage Application through 38kV.
- True RMS three-phase voltage sensing on Normal, Emergency and Load.
- Frequency Sensing on Normal and Emergency.
- Programmable Set points stored in non-volatile memory.
- IMPACC Communication to personal computer either on-site or remote.
- Historical data on most recent Transfers (up to 16 events) viewable at switch. Unlimited history storage (remote) available when used with IMPACC software.
- Wide range of user selectable option combinations
- Load Sequencing
- Engine Start Contacts
- Engine test switch with user selectable Test Mode and Fail-Safe.
- Alarm Contact
  (Multiple alarm functions available)
- Pre-Transfer signal
- Heart Beat Monitor (Flashing Green Automatic Light signifies that the CTIQ Transfer is operating properly)
- Instrumentation
  – Voltmeter (accuracy +/- 1%)
  – Reads Line-to-Line on Sources 1 and 2 and Load
  – Frequency Meter (40-80Hz, accuracy +/-.1Hz)
  – Source Available Time (Both Sources)
  – Source Connected Time (Both Sources)
  – Source Run Time

# Programming

## *BUTTON FUNCTIONS*

Three buttons provide easy access to all commonly used CTIQ Transfer functions.

When the preferred source is connected and the ATS is operating normally, the Automatic indicator light will be flashing and the display window will be blank.

Using the Display Select button, the operator can step through each of the six display families:

- Source 1
- Source 2
- Load
- History
- Time/Date
- Set Point

(NOTE: Stepping through the various display modes does not alter preset values or otherwise affect operation of the ATS.)

Once the desired display family is selected, the user may press the Step button to cycle through specific parameters or metered values shown in the display window.

## *INITIAL PROGRAMMING*

Factory programming will load all customer specified functions and presets. At the customer's request, Cutler-Hammer will add, delete or adjust optional features.

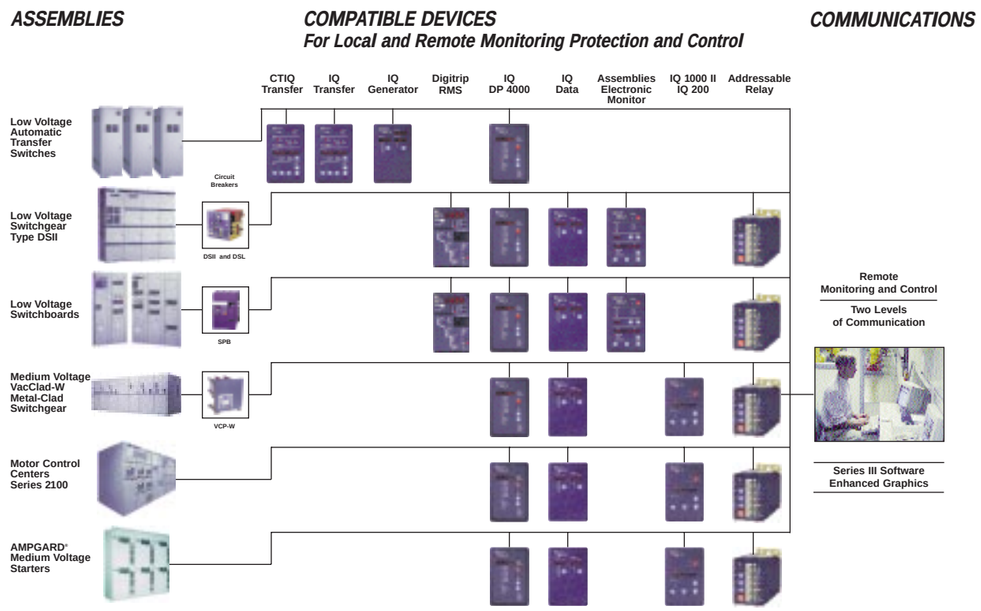
## *CUSTOMER PROGRAMMING*

Customers may reprogram set points and other parameters to match their application, using the Program switch located on the rear of the unit. Once the programming mode has been activated and the Program light is flashing, the user may access Set Point settings by pressing the Display Select button until the Set Points LED is illuminated. Values for individual set points may then be altered by pressing the Increase or Decrease buttons. Once a parameter has been reset, the user advances to the next set point by pressing the Step button.

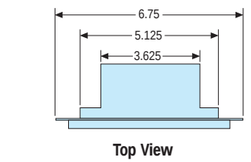
While the CTIQ Transfer is in the Program mode, the device continues to operate in accordance with the previously programmed set points and parameters. The unit is never off-line, and preset values do not change until programming has been completed.

Once reprogramming is complete, the user may return the Program switch to the Run position. At this point, all new values are stored in the CTIQ's non-volatile memory, and the unit returns to Automatic mode.

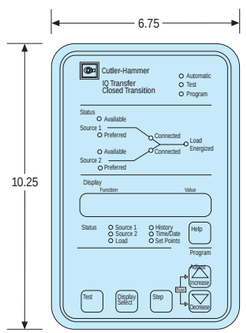
# Using IMPACC, You Can Communicate With Your ATS and Other Electrical Distribution Assemblies



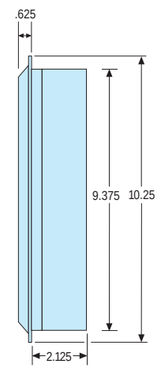

# Dimensions-*Inches*




Top View

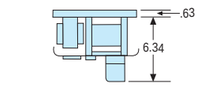



Front View

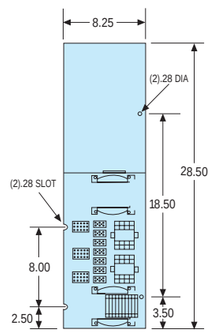



Side View

**Closed Transition IQ Transfer**




Side View




Front View

**Typical Transformer Panel**

***Dimensions are approximate and should not be used for construction purposes (1 inch = 2.54 cm).***

# Closed Transition and The IMPACC System

### *IMPACC — INTEGRATED MONITORING PROTECTION AND CONTROL COMMUNICATIONS SYSTEM*

Cutler-Hammer automatic transfer switches with CTIQ Transfer are ideally suited for the powerful Cutler-Hammer IMPACC System.

### *IMPACC COMMUNICATIONS OPTION*

IMPACC is a noise immune communications system that cost effectively and easily gathers information from metering, protection and control devices. IMPACC provides the capability to control devices and read, log and trend information over a single twisted pair of wire. IMPACC may be installed in new gear or retrofitted into existing equipment.

A variety of IMPACC compatible products can be added to all levels of a commercial or industrial electrical distribution system-from high-voltage substations down to switchboards, panelboards and even individual breakers and motor starters.

Communications wires can be extended up to 7,500 feet from the master control unit without repeaters…and as many as 1,000 compatible devices such as CTIQ Transfer, installed in various assemblies, can be on the IMPACC System.

Adding the communications option to the CTIQ Transfer allows it to be remotely monitored, controlled and programmed. Communications is achieved by mounting a small, addressable communications module, the "IPONI" card, to the back of the unit.

### *EASY INSTALLATION*

Installation is uncomplicated and devices are connected, daisy chain style, via twisted pair conductors. All assemblies and devices are standard Cutler-Hammer equipment when IMPACC compatible devices are ordered as part of an assembly. The assemblies (with compatible devices built in) are prewired, pretested, and delivered complete.

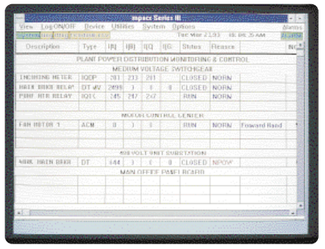
### *CUTLER-HAMMER EXCLUSIVE*

Cutler-Hammer's IMPACC System is the only one that can bring together central control of multiple transfer switches *AND* the rest of the electrical distribution system–all from a single point.

### *FUNCTIONS AVAILABLE THROUGH COMMUNICATIONS:*

- Monitoring and trending of displayed values and device status
- Retrieving historical event information, including diagnostic data at time of transfer
- Testing the device
- Mimic Bus Display

### *SERIES III AND ENHANCED GRAPHICS*



*Example of Series III Screen on PC*

### *SERIES III*

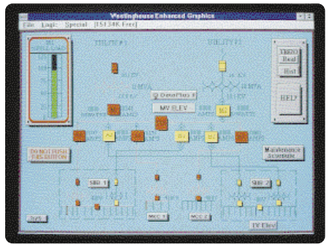
Series III software provides monitoring and recording of power system data as it is occurring. Series III is a Microsoft Windows-compatible application that features user-friendly, menu-driven screens with easy setup and operation. Other features include:

- System/device alarm logging and reporting
- Time/event historical data logging
- Data trending
- Information storage and retrieval by device event
- Hardware diagnostics
- Dedicated computer not required
- Security/password protection

Series III version 6.6 and higher support the CTIQ Transfer.

### *ENHANCED GRAPHICS*

Enhanced Graphics Software provides the capability to generate custom animated color graphics. For example, animated one line drawings of electrical power systems, flow diagrams of processes, equipment elevation views, and other graphical representations may be developed.



*Example of Enhanced Graphics Screen*

### *IMPACC CONNECTIVITY*

IMPACC makes communications easier by providing a wide range of interfaces to other vendors that make the centralization of power distribution information possible. An IMPACC System can easily be linked to building management systems, programmable logic controllers, and distributed control systems. This provides the capability to move data between and across different levels within an installation.

Interfaces have been developed with several vendors including Wonderware, Johnson Controls, Honeywell, Allen-Bradley, Bailey, Expert Edge, Fisher-Provox, Siemens, Foxboro, Iconics, Intellution, and Modicon.

IMPACC connectivity provides for maximum flexibility, meaning computers and PLCs; or multiple computers in various locations can communicate with each other.

Information from Series III can be exchanged via DDE with other Windows™ based programs such as Excel, Word, or any other DDE-compatible program. For higher performance, information can be shared via NET BIOS which connects Series III to Ethernet, Arcnet, or any other compatible network.

# Closed Transition Front Panel Display and Button Functions

### *PROGRAM*

LED indicates unit is in programming mode. (NOTE: This mode is activated using the "Program" switch located on the rear of the unit.)

### *TEST*

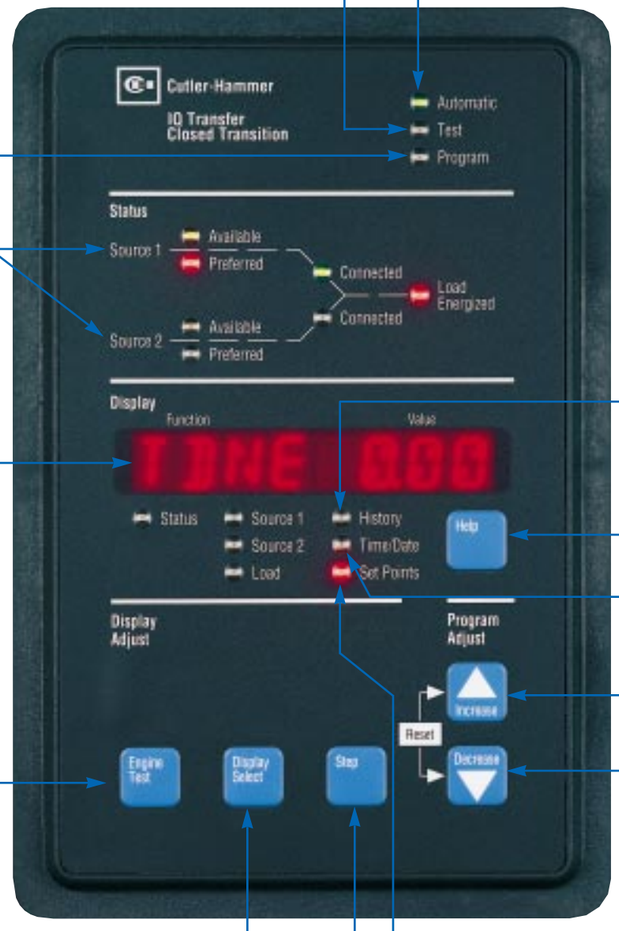
Indicator light is on when unit is in test mode.

### *AUTOMATIC*

LED indicates that the ATS is operating normally and is in the automatic mode.

### *SOURCE 1, SOURCE 2, AND LOAD*

Colored LED lights show status of both Sources and Load.




### *LED DISPLAY*

Unit will provide LED readout showing actual metered values for Voltage, Frequency and Condition (including Normal, Undervoltage, Overvoltage, etc.).

### *TEST BUTTON*

Pressing this button twice initiates an engine test.

### *HISTORY*

By pressing the Display Select button to light the History LED and the Step button to rotate thru available data, historical or cumulative values for Available Time (Both Sources), Connected Time (Both Sources), Number of Transfers and Date/Time Reason for last 16 Transfers are displayed.

### *HELP*

Pressing the Help button in any function mode will bring up display messages, explanations and prompts to assist the operator.

### *TIME/DATE*

Displays real-time clock. Clock can be easily set in this mode using the Increase and Decrease buttons.

### *INCREASE/DECREASE*

A detailed explanation of these buttons can be found in the Operation Section.

### *DISPLAY SELECT*

- Source 1
- Source 2
- Load
- History
- Time/Date
- Set Points

Button is discussed in Operation section.

### *STEP BUTTON*

Shows multiple variables under each display select function.

### *SET POINTS*

Selecting this LED permits the user to display existing programmed values.

### *DEFINITIONS*

**Closed Transition:** Closed transition is a feature that will temporarily parallel two live sources in a make-before-break scheme when performing a transfer. The CTIQ Transfer will close the switching devices for both sources, paralleling both sources, for a maximum time of 100 milliseconds after the sources are synchronized.

**Open Transition/In-Phase Monitor:** In-Phase monitor is a feature that will allow a transfer between two sources only when the phase difference between the two sources is near zero. This is an open transition transfer that prevents in-rush currents from exceeding normal starting currents in the case where motor loads are being transferred.

**Open Transition/Delayed with Load Voltage Decay:** Load voltage decay transfer is a feature that, after opening the switch for the original source, holds in the neutral position until the voltage on the load is less than 30% of rated voltage. This is an open transition that prevents in-rush currents from exceeding normal starting currents in the case where motor loads are being transferred.

### *OPERATION*

The Cutler-Hammer CTIQ Transfer operates in the following modes to meet most load management applications:

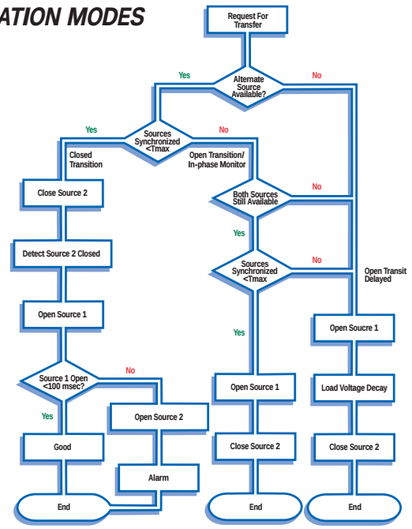
- Loss of Normal Power
  - – Open Transition to Alternate Source
- Normal Power Restored
  - – Closed Transition back to Normal Source
- Peak Shave (Remote or Local)
  - – Closed Transition to and from Alternate Source
- Test (User Selectable)
  - – Load Transfer - Closed Transition to and from Alternate Source
  - – No-Load Transfer - Starts Alternate Power Source and Allows to Run Unloaded. No Transfer Takes Place



## *CLOSED TRANSITION OPERATION MODES*

### *FEATURE SET 47C CLOSED/IN-PHASE/LOAD VOLTAGE DECAY*

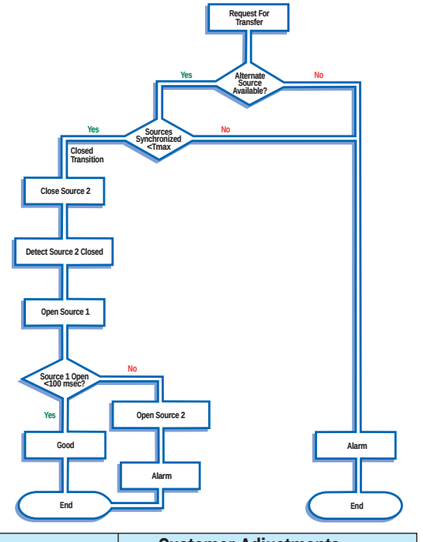
*CTIQ Transfer controllers equipped with Feature Set 47C execute the following sequence of operations upon receipt of a request for transfer: the controller waits (for a pre-selected timeframe) for synchronization of voltage and frequency. If achieved, a closed transition transfer occurs. Failure to synchronize results in the controller defaulting to an In-phase monitor, open transition, mode of operation. If the two sources fail to achieve frequency synchronization within the user selectable range, the controller defaults to an open transition using a Load Voltage Decay delayed transition.*




| Standard Features | Customer Adjustments |
|---|---|
| Closed Transition Frequency Difference (hertz) | 0.0 to 0.3 Hz |
| Closed Transition Voltage Difference (volts) | 1 to 5% |
| In-phase Transition Frequency Difference (hertz) | 0.0 to 3.0 Hz |
| Closed Transition Synchronization Timer | 1 to 60 minutes |
| In-phase Transition Synchronization Timer | 1 to 60 minutes |

### *FEATURE SET 47D CLOSED ONLY*

*CTIQ Transfer controllers equipped with Feature Set 47D only transfer to an alternate source when both sources are synchronized. For synchronization to occur, both voltage and frequency differentials must fall within the user selectable ranges. If synchronization does not occur (within a pre-selected amount of time) the controller will maintain load connection to the current power source and initiate an alarm.*




| Standard Features | Customer Adjustments |
|---|---|
| Closed Transition Frequency Difference (hertz) | 0.0 to 0.3 Hz |
| Closed Transition Voltage Difference (volts) | 1 to 5% |
| Closed Transition Synchronization Timer | 1 to 60 minutes |



## *QUICK SUMMARY OF CLOSED TRANSITION IQ TRANSFER FACTORY OPTIONS AND CUSTOMER ADJUSTMENTS*

The following charts illustrate standard features of a CTIQ Transfer unit as well as factory installed optional features.

| *STANDARD FEATURES* | *FEATURE NUMBER* | *CUSTOMER ADJUSTMENTS* |
|---|---|---|
| Voltmeter for Source 1 | | |
| Voltmeter for Source 2 | | |
| Voltmeter for Load | | |
| Frequency Meter for Source 1 | | |
| Frequency Meter for Source 2 | | |
| Undervoltage Sensing on Source 1 | | 1 Phase or 3 Phase–Depending on System Voltage<br>Dropout Voltage–90% of nominal to 50% of nominal<br>Pickup Voltage–100% of nominal to (Dropout + 2%) |
| Undervoltage Sensing on Source 2 | 5J | 1 Phase or 3 Phase–Depending on System Voltage<br>Dropout Voltage–90% of nominal to 50% of nominal<br>Pickup Voltage–100% of nominal to (Dropout + 2%) |
| Underfrequency Sensing on Source 2 | 5J | Dropout Frequency–100% of nominal to 90% of nominal<br>Pickup Frequency–110% of nominal to (Dropout + 1 Hz.) |
| Time Delay Normal to Emergency | 1 | Adjustable 0-1800 Seconds |
| Time Delay Emergency to Normal | 3 | Adjustable 0-1800 Seconds |
| Time Delay Engine Start | 2 | Adjustable 0-120 Seconds |
| Time Delay Engine Cooldown | 4 | Adjustable 0-1800 Seconds |
| System Selection | | Utility/Generator or Dual Utility or Dual Generator |
| Position Indicators | 12C, 12D | |
| Source Availability Indicators | 12G, 12H | |
| Preferred Source Indicator | | |
| Load Energized Indication | | |
| History<br>• Source Availability Time<br>• Source Run Time<br>• Source Connected Time<br>• Load Energized Time<br>• Number of Transfers<br>• Date, Time, and Reason for last 16 Transfers | | |
| Viewable Setpoints | | |
| IMPACC Capability | | Communications via IMPACC on Personal Computer |
| Real Time Clock | | Set Time and Date |
| Programmable Engine Test | 6 | Run Engine Only or Load Test |
| Remote Alarm Contact | | |
| Auxiliary Relay Contacts | 14C, 14D | |

| *OPTIONAL FEATURES* | *FEATURE NUMBER* | *CUSTOMER ADJUSTMENTS* |
|---|---|---|
| Overvoltage Sensing on Source 1<br>Pickup Voltage–95% of nominal to (Dropout–2%) | 26C | Dropout Voltage–120% of nominal to 105% |
| Overvoltage Sensing on Source 2<br>Pickup Voltage–95% of nominal to (Dropout–2%) | 5E | Dropout Voltage–120% of nominal to 105% |
| Underfrequency Sensing on Source 1 | 26E | Dropout Frequency–100% of nominal to 90% of nominal<br>Pickup Frequency–110% of nominal to (Dropout + 1 Hz.) |
| Overfrequency Sensing on Source 1 | 26F | Dropout Frequency–120% of nominal to 100% of nominal<br>Pickup Frequency–90% of nominal to (Dropout–2%) |
| Overfrequency Sensing on Source 2<br>(Also includes Overvoltage Sensing on Source 2 | 5K | Dropout Frequency–120% of nominal to 100% of nominal<br>Pickup Frequency–90% of nominal to (Dropout–2%) |
| Time Delay Bypass Pushbutton | 8C or 8D | |
| Manual Return to Source 1 | 29E | |
| Preferred Source Selection | 10B or 10D | Selectable–Source 1 or Source 2 or None |
| Maintenance Selector Switch | 9 | |
| Plant Exerciser W/ Real Time Clock | 23J | Set Mode (Load or No-Load Test) with Fail Safe and Time and Day of Exercise |
| Interruptible Rate (Area Protection) | 26D | |
| Inhibit to Emergency | 36 | |
| Load Sequencing | 45 | Up to 10 Devices |
| Pre-transfer Signal | 35 | Time Delay Initiated or Confirmation Initiated (up to 10 Devices) |
| Phase Rotation (Contact Factory for availability.) | 5H or 26H | |