S&C Micro-AT Source-Transfer Controls are designed for use in S&C Metal-Enclosed Switchgear and Source-Transfer Pad-Mounted Gear, in conjunction with power-operated S&C Mini-Rupter® Switches or S&C Alduti-Rupter® Switches, to provide automatic source transfer for common-bus or split-bus primary selective systems rated through 34.5 kV.

When so applied, Micro-AT Source-Transfer Controls ensure a high degree of critical-load continuity by minimizing interruptions resulting from the loss of one source. Excluding the intentional time delay to coordinate with upstream protective devices and/or transition dwell time,● transfer is achieved in 10 cycles when the control is combined with power-operated Mini-Rupter Switches or 3 seconds when the control is combined with power-operated Alduti-Rupter Switches.

● An adjustable time delay to allow motor residual voltage—the voltage appearing at the terminals of a connected motor when the source is interrupted—to drop sufficiently before the service is restored.

Figure 1. Micro-AT control installed in the S&C Source-Transfer Pad-Mounted Gear.

Features

The Micro-AT Source-Transfer Control uses an electronic microprocessor to perform control operations, as directed by settings programmed into the device at the factory and in the field. Such settings—consisting of the control's operating characteristics and voltage-, current-, and time-related operating parameters—are entered into the control by means of a keypad on the front panel. See Figure 2 on page 3.

To simplify entry of this information and to permit its quick review on the LCD indicator, the operating characteristics have been grouped together as a series of items in the **Configure** menu. Similarly, the voltage-, current-, and time-related operating parameters have been grouped together as a series of items in the **Voltage**, **Current**, and **Time** menus, respectively. A particular item can be accessed for display by first pressing the appropriate menu key and then scrolling through the items, using the NEXT or LAST item key. To prevent unauthorized changes to the operating characteristics and operating parameters, each item is protected by an access code; the correct access code must be entered before the item can be altered.

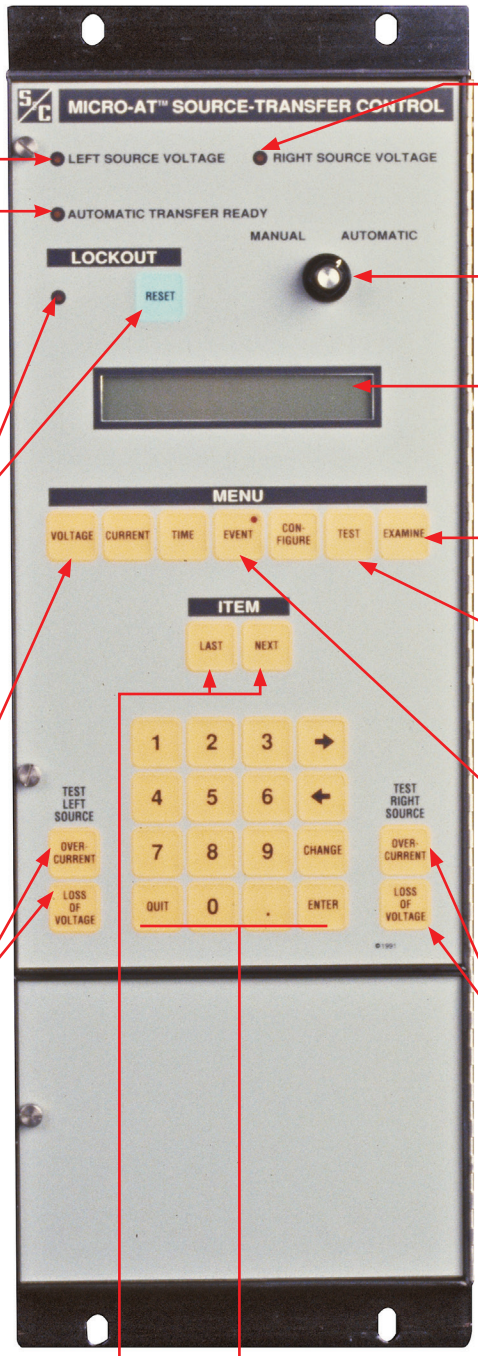
The **Test** menu provides the means for checking the functioning of the source-transfer control and is also used to enable the test keys for simulating overcurrent and/or loss of voltage on the sources.

The Micro-AT Source-Transfer Control features powerful built-in diagnostic tools. The control automatically records system status and the status of the device's controller circuits every time a control operation occurs. Each such operation, referred to as an "event," is indicated by the illumination of a lamp on the EVENT menu key and is available for display under this menu. Further, the control has available for display, as items under the **Examine** menu, the present source voltage and current inputs and the present status of discrete inputs to and outputs from the control.

Proven Solid-State Circuitry

S&C solid-state electronic devices offer the superior reliability and serviceability required for the rigors of operation in power equipment. Metal-oxide surge protectors at critical points in the control circuits provide optimum surge protection; S&C's unique surge control has been field-proven through years of successful application in hostile utility-substation environments. And the capability of every S&C electronic device to withstand voltage surges is confirmed by two factory quality-check tests: The ANSI Surge Withstand Capability Test (ANSI Standard C37.91.1); plus a much more severe (5-kV, 3.75-joule) capacitive-discharge test specially developed by S&C to duplicate or exceed voltage surges measured in Extra-High Voltage (EHV) power substations. The specified surges are applied at all terminals of the device. Additional tests are performed to identify and eliminate any components that might be prone to early failure. They include a dielectric test—a 72-hour screening test consisting of 24 hours at maximum-design operating temperatures followed by 48 hours of temperature cycling—and functional tests (both before and after the screening test).

Printed-circuit-board construction ensures high reliability. All components are applied at well below MIL-STD design guidelines, minimizing component stress, power-supply requirements, and internal heating. Voltage-level settings are maintained within ±3% accuracy over an ambient temperature range of –40°F (-40°C) to +160°F (+71°C). Interconnecting-cable connector pins and receptacle contacts are gold-over-nickel plated. And all output relay contacts are silver alloy cadmium free to ensure long service life. Output circuits are relay isolated.



LEFT SOURCE VOLTAGE indicating lamp indicates presence of "acceptable" voltage on the left source.

AUTOMATIC TRANSFER READY indicating lamp provides straightforward indication that source-transfer control, interrupter switches, and switch operators are in the correct positions and modes for automatic source transfer. The LCD indicator, when not showing menu information, shows messages explaining why this lamp is not lit.

OVERCURRENT LOCKOUT indicating lamp and RESET key. (Applicable to metal-enclosed gear equipped with S&C Current Sensors on the sources.) Blue lamp lights when an overcurrent occurs in excess of the preset level setting; automatic source transfer is prevented until the control is reset.

Unbalanced voltage detection. (Applicable to metal-enclosed gear equipped for three-phase voltage sensing.) Initiates automatic source transfer if an unbalance condition occurs exceeding the preset reference level.

TEST keys for simulating overcurrent and loss of voltage on left source.

RIGHT SOURCE VOLTAGE indicating lamp. Indicates presence of "acceptable" voltage on right source.

MANUAL/AUTOMATIC OPERATION selector switch. When in manual position, prevents an automatic source transfer; permits manual operation using the OPEN/CLOSE pushbuttons on the gear.

Two-Line 48-character backlit LCD indicator.

EXAMINE menu key allows review of present source voltage and current inputs, and the present status of discrete inputs and outputs from the source-transfer control.

TEST menu key for checking functioning of the control's lamps, display, and keypad. Also used to enable TEST keys for simulating an overcurrent or loss of voltage on the sources.

EVENT menu key allows display of system status, control status, and operating conditions for past control operations. Each operation is indicated by illumination of the lamp on the key. The last 130 events are stored in memory at any given time.

TEST keys for simulating overcurrent and loss of voltage on right source.

LAST and NEXT item keys.

Keypad

Figure 2. Close-up of front panel features.

Common-Bus Primary-Selective System Applications

Under normal operating conditions in a common-bus primary-selective system, the preferred-source interrupter switch is closed and the alternate-source interrupter switch is open. See the top portion of Figure 3 on page 5.

The Micro-AT Source-Transfer Control monitors the condition of both power sources and initiates automatic switching when preferred-source voltage has been lost (or reduced below a predetermined level) for a period of time sufficient to confirm the loss is not transient. The preferred-source interrupter switch is automatically opened, and the alternate-source interrupter switch is then automatically closed, restoring service to the load.

Depending on how the control was field-programmed, Return To The Normal Circuit Configuration Preferred Source Interrupter Switch Closed, Alternate-Source Interrupter Switch Open operation may be performed automatically on restoration of normal voltage to the preferred source, after a delay sufficient to establish the return is not temporary (**Automatic Return** mode) or manually at a convenient time (**Hold Return** mode).

In the **Automatic Return** mode, return-of-source transfer may be accomplished with the Open Transition or Closed Transition schemes. With the Open Transition Retransfer scheme—used when the power sources are not to be paralleled—the alternate-source interrupter switch opens before the preferred-source interrupter switch closes with a momentary interruption of service to the load. With the Closed Transition Retransfer scheme—selected when it is permissible to parallel the sources so that there will be no interruption of service to the load—the alternate-source interrupter switch will open after the preferred-source interrupter switch closes. In the **Hold Return** mode, if the alternate-source voltage fails (and voltage has been restored to the preferred source), an Automatic Open-Transition Return-Of-Source Transfer operation will take place so the load is served from the preferred source.

Split-Bus Primary-Selective System Applications

In a basic split-bus primary-selective system, the switchgear bus is divided into two sections by a bus-tie switch. See the bottom of Figure 3 on page 5. The switchgear normally operates with the two source interrupter switches closed and the bus-tie interrupter switch open so each bus section receives power from its associated, separate source. Each source, in effect, is the preferred source for its section of the bus and the alternate source for the other section of bus. Typically, each source cable is sized for normal operating conditions and is loaded to rated capacity. Since under emergency conditions most installations have some loads which can be shed, it's not necessary for either source to carry the switchgear's total load over an extended period of time. Full use of both sources precludes the need for the serving utility to maintain idle substation and feeder capacity. And because the switchgear's load is segmented by the split bus, only a portion of the total load is transferred when a source is lost, greatly reducing the likelihood of the alternate source tripping out when transfer takes place.

The Micro-AT Source-Transfer Control monitors the condition of both power sources and initiates automatic switching when voltage on one source has been lost (or reduced below a predetermined level) for a period of time sufficient to confirm the loss is not transient. The interrupter switch associated with that source is automatically opened and the bus-tie interrupter switch is then automatically closed so all the loads are served from the remaining source.

Depending on how the control was field-programmed, a **Return to the Normal Circuit Configuration-Bus-Tie Interrupter Switch Open and Both Source Interrupter Switches Closed** operation may be performed automatically on restoration of normal voltage to the affected source after a delay sufficient to establish the return is not temporary (**Automatic Return** mode) or to be manually performed at a convenient time (**Hold Return** mode).

In the **Automatic Return** mode, return-of-source transfer may be accomplished with **Open Transition** or **Closed Transition** operations. With the Open Transition Retransfer scheme—used when the power sources are not to be paralleled—the bus-tie interrupter switch opens before the affected source interrupter switch closes with a momentary interruption of service to the load. With the Closed Transition Retransfer scheme—selected when it is permissible to parallel the sources so there will be no interruption of service to the load—the bus-tie interrupter switch opens after the affected source interrupter switch closes. In the **Hold Return** mode, if the source in use fails (and voltage has been restored to the other source), an Automatic Open-Transition Return-of-Source Transfer operation will take place so the load is served from the restored source.

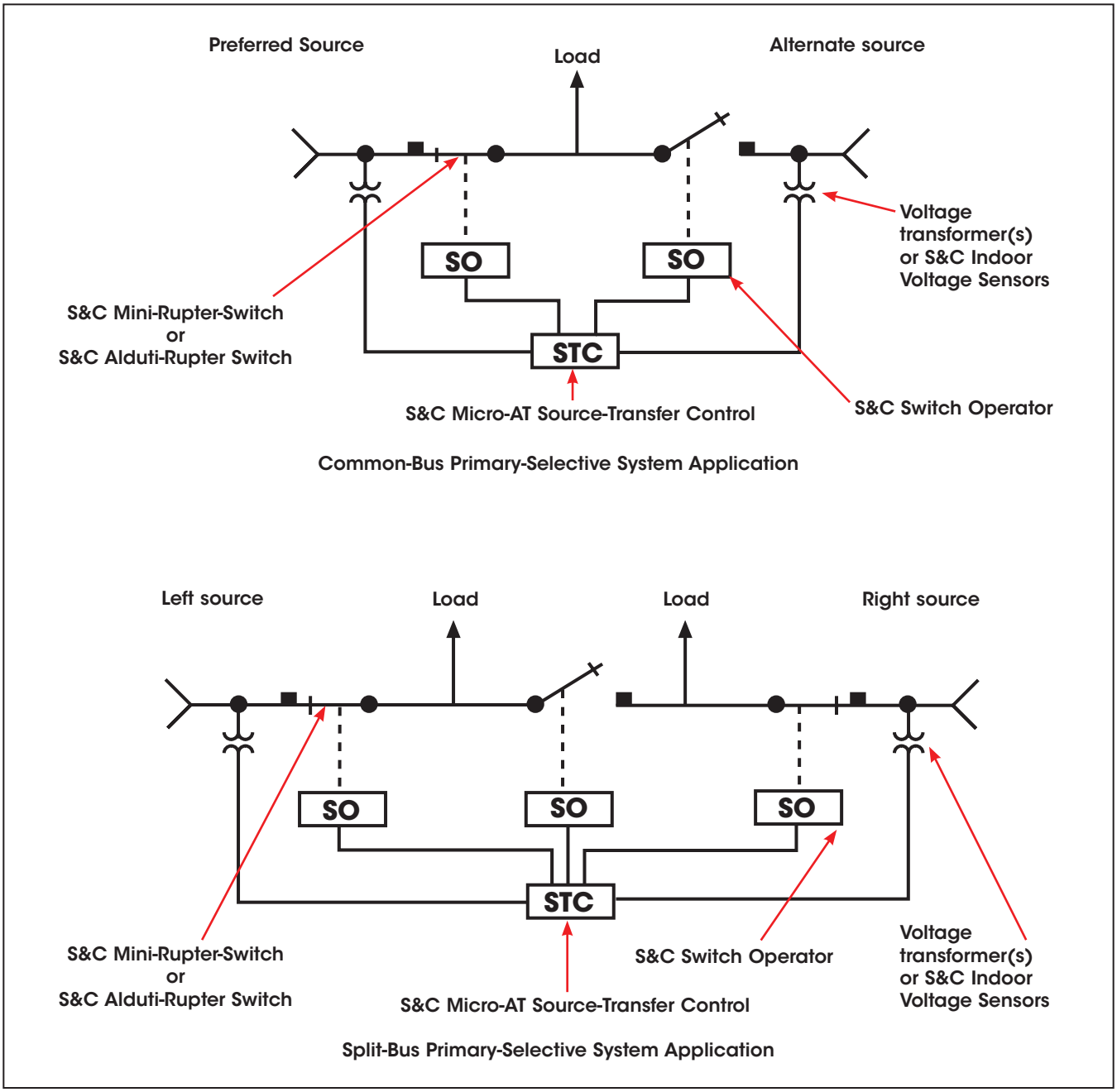


Figure 3. Application of Micro-AT Source-Transfer Controls in common-bus and split-bus primary-selective systems.

Voltage Sensing

In S&C Metal-Enclosed Switchgear, the voltage-sensing input circuitry of the Micro-AT Source-Transfer Control accommodates either of the following single-phase or three-phase voltage-sensing schemes:

- For single-phase sensing, one line-to-ground connected voltage transformer per source
- For three-phase sensing, three line-to-ground connected voltage transformers, one line-to-ground connected voltage transformer and two S&C Indoor Voltage Sensors per source, or two line-to-line connected voltage transformers per source

In S&C Source-Transfer Pad-Mounted Gear, the voltage-sensing input circuitry of the Micro-AT control accommodates three-phase voltage sensing provided by three S&C Indoor Voltage Sensors per source.

In the event that, on either source, the voltage sensed by the voltage transformer or voltage sensor on phase 2 is higher or lower than the known output voltage of another voltage transformer on the system (as determined by independent measurement), the Micro-AT Source-Transfer Control may be field-programmed to **Set Base Left** and/or **Set Base Right** settings. In so doing, the voltage-sensing input circuitry of the source-transfer control is calibrated to this known voltage.

In instances where the metal-enclosed gear has been equipped for three-phase source voltage sensing, an output-voltage magnitude unbalance and/or phase-angle unbalance will likely exist between the sensing devices on each source. The Micro-AT Source-Transfer Control may be field programmed to **Normalize Left** and/or **Normalize Right** settings to compensate for such differences on the left source and the right source, respectively.

Unbalance Detection

An **Unbalanced Voltage Detection** feature may be field programmed in the Micro-AT Source-Transfer Control in instances where the metal-enclosed gear has been equipped for three-phase voltage sensing. This feature protects the loads from any source-side open-phase condition at the same system voltage level as the metal-enclosed gear— whether caused by utility-line burn-down, broken conductors, single-phase switching, equipment malfunctions, or single-phasing resulting from blown source-side fuses. The unbalance detection feature continuously develops and monitors the negative-sequence voltage to detect any unbalance present as the result of an open-phase condition.

If the voltage unbalance exceeds a preset reference level for a period of time sufficient to confirm the loss is not transient, an output signal is produced that initiates automatic transfer to the other source. By monitoring negative-sequence voltage, the unbalance detection feature detects virtually all source-side open-phase conditions, even those where backfeed defeats simple voltage-magnitude sensing schemes.

Overcurrent Lockout

An **Overcurrent-Lockout** feature may be field-programmed in the Micro-AT Source-Transfer Control in instances where the metal-enclosed gear has been equipped with S&C Current Sensors on the sources. This feature prevents an automatic-transfer operation that would close a source interrupter switch or bus-tie interrupter switch into a fault, thereby avoiding further utility-system disturbance.

An overcurrent in excess of the preset level will activate the lockout circuit in the control. If the overcurrent is caused by a fault cleared by a source-side protective device, the prolonged loss of voltage will cause the associated source interrupter switch to open. At the same time, a **Lockout** mode will activate in the source-transfer control so the other source interrupter switch or the bus-tie interrupter switch will not automatically close into the fault. (If the overcurrent is caused by a fault that is cleared by a load-side protective device, however, there will be no prolonged loss of voltage, so the source-transfer control will not initiate any switching operations.)

The **Lockout** mode may be externally reset; however, a terminal block must be included in the metal-enclosed gear for attachment of user-furnished control wiring providing the appropriate reset signal.

Supervisory Control

A **Supervisory-Control** feature may be field programmed in the Micro-AT Source-Transfer Control, permitting switch operation from a remote location. This feature also requires that the metal-enclosed gear be equipped with a terminal block for attachment of user-furnished control wiring providing the appropriate supervisory control signals.

Remote Indication

A **Remote Indication** feature may be optionally furnished in the Micro-AT Source-Transfer Control. This feature permits remote monitoring of the presence or absence of source voltages, the **Manual** or **Automatic** operating mode, the status of the READY indicator, and the **Overcurrent Lockout** state. This feature requires that the metal-enclosed gear be equipped with a terminal block for attachment of user-furnished control wiring to remote indicators.

Test Panel

A **Test Panel** feature may also be optionally furnished. This feature permits checkout of the source-transfer scheme, unbalance detection, and overcurrent lockout using an external, adjustable three-phase source.